ENGINEERING AND MINING JOURNAL

MAY, 1941

Ore for the nation's steel. A shovel in the Hull-Rust pit at Hibbing, Minn.

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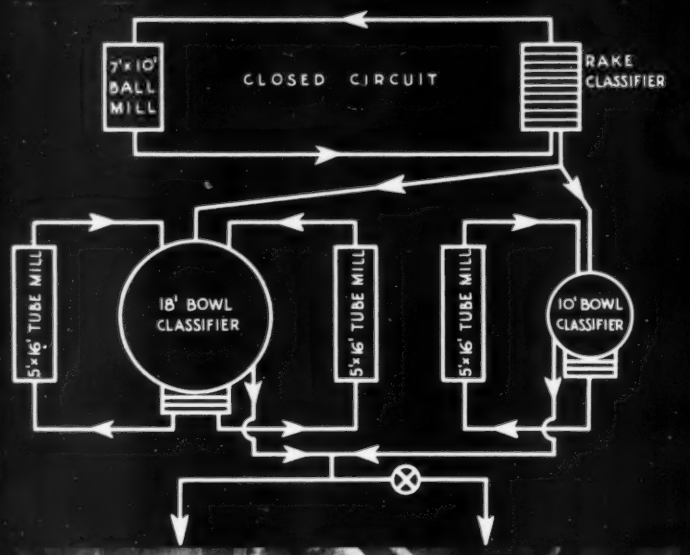

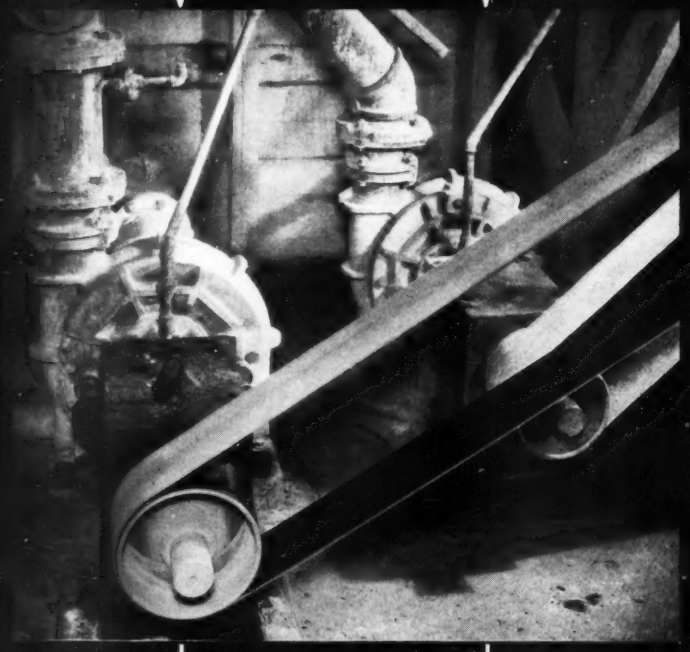

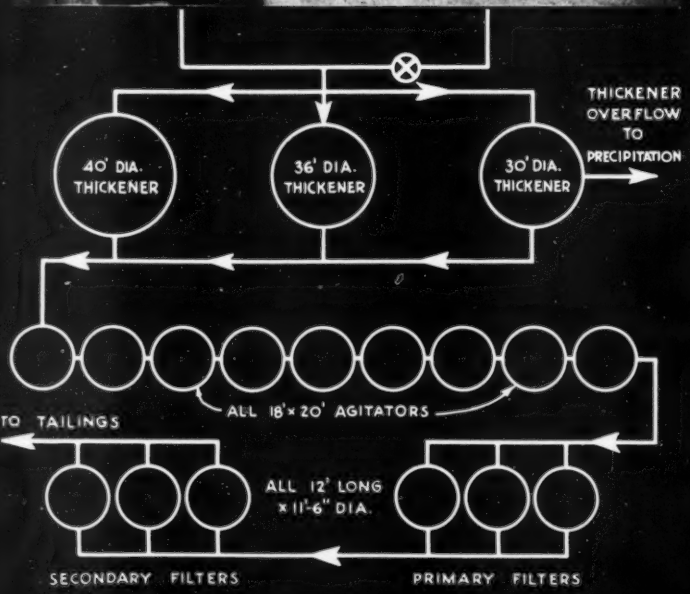

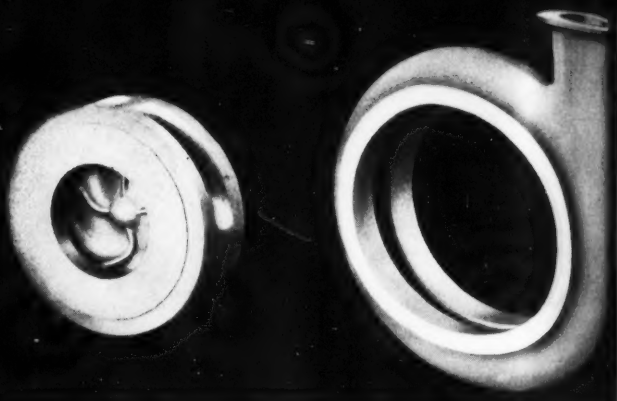

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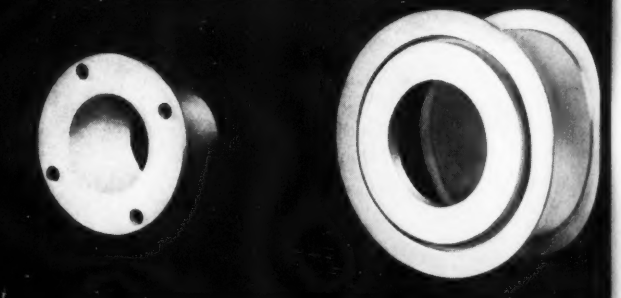

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From 1866 to 1941 is 75 years. Seventy-five years of service to the mining industry is the *E&MJ.* record as of August this year. This Diamond Jubilee Issue will briefly mark the past, dwell on the present, and glimpse the future. All mining men will find many interests in this August feature issue.

▼

In this issue some preliminary statistics are given on copper ore in the United States from the 1939 census of mineral industries which indicate many interesting economic and technical trends. For instance, the number of producing copper mines reported in 1939 was almost 72 percent less than in 1929, while the previous decade had only recorded an 8 percent reduction in number of operations. Meanwhile, output of crude copper ore mined per man-hour almost doubled and the recoverable copper content of the ore mined per man-hour increased 67 percent. Many other facts and figures are disclosed.

▼

Speaking of armaments, Copper and Brass Research Association points to the fact that recent archeological discoveries have located part of the buried city of Ezion-geber, site of King Solomon's naval base on the Red Sea, and that nearby ancient copper smelting plants, ore fragments, and finished copper articles were found. *E&MJ.* wonders "what price copper" in those war days!

▼

As approximately 85 per cent of the iron ore consumed in the United States moves through the Great Lakes, the announcement of the transportation division, Office for Emergency Management, on April 10, that 90 percent of the iron-ore fleet would be in commission that night, records the earliest opening of Lake navigation in history. This "break" indicates that even the elements are cooperating in the interests of national defense.

H. C. PARMELEE
Editor

ENGINEERING AND MINING JOURNAL

H. W. CLARKE
Vice-President

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YUBA DREDGES

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TIN...

Pacific Tin Consolidated Corporation Dredge No. 6, (Yuba No. 130) pictured above was built by Yuba after cooperating with the owners in its design. The knocked-down steel hull and superstructure, housing, and machinery units were shipped from United States. The dredge was erected in Federated Malay States; operations starting in November, 1938.

Incorporated in its design are many special features for puddling clay, including two log washers and three extra screens. Equipped with 13½ cu. ft. buckets, the dredge is capable of digging 75 ft. below water level with the ladder at 45 degrees to horizontal. The hull is 11 ft. deep, 72 ft. wide, and 202 ft. long. The dredge is electrically operated, digs on a headline, and is fully equipped with jigs for tin recovery.

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Volume 142 MAY, 1941 Number 5

Reflections from Washington

SO DIRECT AND VITAL is the influence of the Government on the fortunes of the mining industry in these times, that news emanating from Washington has exceptional and timely interest. That being true, we have decided to give our Washington letter a more prominent position in the *Journal*, at least for the duration of the emergency. So beginning in this issue "Reflections from Washington" will be found immediately following these editorial pages. The information therein contained will, in every sense of the word, reflect Washington activities and views of public officials affecting the mining industry. Our correspondent will endeavor to present these matters without personal bias. You may agree or disagree, but we urge you to keep abreast of developments in Washington, because things of an economic and political character are happening there that are bound to affect not only the present but also the future of the mining industry.

Mechanization Trends Underground

FACED with a multitude of problems brought about by changing domestic and foreign conditions, the mining industry is making a considerable effort to control operating costs. Management is surveying plants with respect to equipment, production methods, operating schedules, and waste, because only by close attention to these matters can excessive costs be avoided at both large and small properties.

Observations in the field indicate that there is a slow but steady trend toward mechanization of underground mining operations, especially at properties employing block-caving methods. Whereas a year ago shaking conveyors were used for what some superintendents called "salvage work" (blocks of ore already half mined), now entire blocks of ore are being developed and laid out for shaking-conveyor transportation exclusively. The tempo of this movement will be accelerated greatly as soon as normal conditions return.

Mechanical transportation by locomotives on levels, both main and subordinate, is an accepted feature, and is applicable to most mining operations. In many mines chute-loading is also a method of long standing. It is only comparatively recently that efficient small mechanical loaders have been available, and now "development loading" can be said to be almost completely solved. Flat workings, too, are served by loaders of various types. The scraper is an important auxiliary, and serves to concentrate broken ore at ore passes and loading points.

Blast-hole drilling by air-operated drills is almost universal practice, but improvements in diamond drills are introducing new methods. Indications are that some type of rotary electric drill will meet many of the situations where air drills are now in use. Significant improvements are being made in diamond-drill bits and drills, and Noranda's stoping practice with long boreholes has stimulated study of improved mining methods. Possible elimination or control of drilling dust is an additional incentive to the use of rotary electric drills for blast holes. In a word, new machines for specialized applications offer mine management new opportunities to improve underground mining practice.

Chickens Come Home to Roost

THERE IS MORE THAN A TRACE of irony in the unseemly behavior of organized labor during the defense emergency, considering the legislative precautions taken by the Administration to insure satisfactory behavior on the part of industry. If memory serves us well, industry is subject to conscription of plants and facilities in case the Government thinks it is not performing up to expectations. The New Deal just *assumed* that industry would be refractory, and so provided the pillory in which it could be exposed to public scorn and humiliation.

But something went awry. Industry rallied to the support of the defense program, as we knew it would; but labor promptly took advantage of the emergency to gain selfish ends, sabotaging the defense program here and there by wasting millions of man-days of production. Industry has been put in a strait-jacket of price

control and taxation, but no official raises a harsh voice against the racketeering that characterizes large groups of organized labor. The President must have been irked at the actions of the beneficiaries of the Wagner Act and the National Labor Relations Board, but his public utterance on the subject went only so far as to say that *both* labor and capital should have patriotic regard for the nation's emergency.

The whole labor situation is lopsided as a result of the Administration's attitude in the past. The President asks the Southern coal operators to resume negotiations with John L. Lewis—he of rule-or-ruin fame—which is tantamount to asking them to accept his terms. Madam Perkins, "a study in bewilderment," is unmoved by the strike situation, and of little use in it as Secretary of Labor. Asked direct questions, she either evades a straightforward answer or counters with another query. Leon Henderson freezes commodity prices, but dodges the issue of wage increases and their effect on cost of production. He leaves the inference that if anybody must be sacrificed in the emergency, stockholders will have to "take the rap." Labor is in the saddle, and its partisans are in political office.

We believe in organized labor and wish it well. We favor wages as high as labor can earn out of efficient production. But we could wish that labor had more intelligent and less crafty leaders; that they and their supporters in the Government were disposed to play fair; and that it had virile representation in the President's cabinet. The English do these things better than we do, being fifty years ahead of us, and until we learn the lessons they have had to learn we shall reap the whirlwind whenever we sow the wind. Public opinion, and even legislative action, will not long be denied a correction of the strike situation, particularly in defense industries.

Copper Excise Tax Continued to 1945

MANY IN THE COPPER INDUSTRY were taken by surprise last month when they learned for the first time that the excise tax of four cents a pound on copper had long since been extended to June 30, 1945. The news broke publicly when Louis S. Cates, president of Phelps Dodge Corporation, stated in a report to stockholders that the extension had been provided in the Revenue Act of 1940. Inquiry in the industry revealed that few knew of the change. Up to that time it had been generally assumed that, without further legislation, the tax provision would expire June 30, 1941. But hurried reference to the Revenue Act of 1940 showed how unobtrusively the extension had been accomplished. In a brief paragraph headed "Continuation of Excise Tax," it was stated that the act of 1939 was amended by "striking out '1941' wherever appearing therein and inserting in lieu thereof '1945'." Simple and effective legislation, without reference to the items affected!

Supply and Demand in Metals

AS THE FIRST FOUR MONTHS of 1941 ended, producers and consumers of nonferrous metals were still pondering the question of how much metal would be required for the all-out defense effort, and what tonnages would be available for non-defense work. Inability to answer this question makes for general confusion and price uncertainties in all divisions of the metal industry. Although output of metals has been increasing, the desire of consumers to accumulate supplies has not been quenched. A strong anti-inflation price policy in Washington has checked upward price movements, but evidently consumers have not yet been convinced that the authorities can maintain orderly markets indefinitely.

Studies have been made of consumers' stocks of raw materials, but invariably these have revealed little more than normal gains in reserves. In view of the abnormally large deliveries over a period of more than six months, the accuracy of inventory figures is doubted in some quarters. Producers believe that inventories of finished and semi-finished goods must have increased markedly. The automobile industry, it is pointed out, produced more than 500,000 cars a month for five months in succession.

The next phase of a badly warped supply situation is getting under way. The abnormal demand for raw materials for non-defense work is due to subside, voluntarily or otherwise. The automobile industry, an important outlet for non-ferrous metals, has willingly accepted an initial 20 percent reduction in the production of motor vehicles for the model-year beginning August 1. Galvanizers are reducing the thickness of the coating to conserve zinc. Production of brass pipe high in zinc content is being restricted. Aluminum and magnesium consumers are reducing requirements.

Representatives of the can-making companies have informed OPM that the weight of the tin coating on cans could, if necessary, be reduced

10 percent for fully 95 percent of tin-can uses. Manganese ore consumers stand ready to absorb a larger percentage of low-grade ore and at the same time take more spiegeleisen. In short, conservation in the use of defense materials, and substitutions, should aid materially in balancing the supply situation. Moreover, it appears that some of the rough guesses on war needs in copper and zinc may prove excessive.

Deliveries of refined copper to domestic consumers during March amounted to the huge total of 134,333 tons, of which 31,201 tons was metal of foreign origin released by the Metals Reserve Company. Without exact knowledge of what propotion of the deliveries represented actual consumption, interpretation of the figures is a hopeless task. Conservatives continue to seek a happy medium in estimating future needs. Little is gained by creating artificial shortages by frightening consumers.

Tin From Tin Cans

ONE OF THE POPULAR ILLUSIONS is that avoidable waste results from failure to recover tin from used tin cans. The man on the street knows that millions of tin cans litter garbage dumps and alleys, and he wonders why, in the face of tin shortage, this apparent waste is allowed to go unheeded.

For his information wide publicity should be given to a recent report on the subject by a committee of the National Academy of Sciences to the Office of Production Management. Briefly, the committee concludes that the recovery of tin from used containers is not "an undertaking which 'venture' capital would make if it is competently advised." Further, the committee recommends that the Government should not build any detinning plants "unless and until an emergency in the supply of tin renders it imperative to conserve tin without regard to its cost." In short, commercial recovery of tin from tin cans is uneconomic, regardless of appearances.

United States consumption of tin for containers is of the order of 35,000 to 40,000 long tons per annum. Of this quantity the committee estimates that perhaps 12,000 long tons might be recovered *if* the problem of economical collection were solved.

Obvious difficulties in the way of conserving tin from this source include: transportation of a bulky product; removal of paper labels, lacquers, and lithograph coatings; cleaning the cans of remnants of their original contents; and ultimate disposal of detinned scrap containing at least 0.1 per cent tin, which is an undesirable product in the steel industry. Technically, the problem is not beyond solution with existing knowledge and experience; economically, the undertaking would be ill-advised.

Two Percent for Research

WITH AN EYE TO THE FUTURE, particularly on ways and means of keeping the United States at work after the defense emergency has passed, Dr. Karl T. Compton, president, Massachusetts Institute of Technology, has again emphasized the necessity of directing research to the development of new products and processes. "If all American industry," he says, "spent two per cent of gross sales income for research, there could be mobilized in America a quarter of a million scientists and engineers and a billion dollars a year for the development of new goods, new services, new industries, new jobs, and new sources of wages and salaries." The recommendation is timely and appropriate for the producers and fabricators of non-ferrous metals. What with the prospect of losing some markets to substitutes like plastics, plus the glut of metals likely to exist after the war and the defense program are ended, metals may well be the subject of product research. Always important at any time, it is imperative now.

Controlling Inflation

COMMENDABLE EFFORTS are being made by some intelligent leaders in the defense program to avert inflation—the kind that causes prices and wages to chase each other upward in a vicious spiral, only to come tumbling down disastrously in the final act. One of the most sensible statements we have seen on the subject was made by Donald M. Nelson, director of purchases, Office of Production Management. Asking "Can we keep that from happening to us?" he answers, "We not only can; we have got to." Then he cites three things to do to avert catastrophe: first, expand industrial production to the limit of our capacity in men and machines; second, reduce the volume of civilian spending by taxation; and third, control prices. The last policy has already been inaugurated, the second is in the offing, and the third—most difficult of all—remains to be done. As an experienced business executive, Mr. Nelson knows whereof he speaks, and properly assumes that the results of such a program will be worth the sacrifice. The lessons of the last war should not be easily forgotten.

Reflections from Washington

METAL PRODUCTION will be increased by any means necessary. This is the avowed purpose of Leon Henderson as head of the newly established Office of Price Administration and Civilian Supply. The exact legal authority for achieving the desired end is not clear. But the President implies that whatever authority Mr. Henderson seems now to lack will be provided in due time as the need develops.

There are three purposes in this effort: First is the obvious Emergency need. Second (Henderson's nominal duty), the provision of adequate supplies for civilian uses, including the prevention of price rises. And third, not fully admitted, but only lightly hidden, is the desire to have generous supplies of all metals in the post-Emergency period, so that the prices may be lowered to encourage greater consumption.

The individual items of spot news which bear on this situation are much less important than the long-term trend shown. It is evident that the effort is to be extended over the major nonferrous metals and to most of those ferro-alloying elements for which any domestic production can be developed. Metals are, of course, not alone in the interest of OPACS. Practically every other industrial and consumer item is expected sooner or later to come in for attention if there is any remote probability of either shortage or abrupt price increase.

The Set-Up of OPACS

WASHINGTON was not surprised that Leon Henderson was given large new authority in the establishment of the Office of Price Administration and Civilian Supply. He had done to the great satisfaction of the President his job of controlling industrial goods prices. He is, therefore, established with very complete authority to carry out the larger job which the Presidential order defined most importantly as follows:

"a. Take all lawful steps necessary or appropriate in order (1) to prevent price spiraling, rising costs of living, profiteering, and inflation. . . . (2) to prevent speculative accumulation, withholding, and hoarding of materials and commodities; (3) to stimulate provision of the necessary supply of materials and commodities required for civilian use, in such manner as not to conflict with the requirements of the War, Navy, and other departments . . . and (4) after the satisfaction of military defense needs to provide, through the determination of policies and the formulation of plans and programs, for the equitable distribution of the residual supply of such materials and commodities among competing civilian demands.

"b. Make studies of the Nation's civilian requirements for materials and commodities, the supply of goods and services, the status and trend of prices and factors thereof, and the impact of the defense program upon civilian living standards. . . .

"c. Determine and publish, after proper investigation, such maximum prices, commissions, margins, fees, charges, or other elements of cost or price of materials or commodities, as the Administrator may from time to time deem fair and reasonable; and take all lawful and appropriate steps to facilitate their observance.

"d. Advise and make recommendations to other departments and agencies, whenever the Administrator deems it appropriate, in respect to the purchase or acquisition of materials and commodities by the Government, the prices to be paid. . . .

"e. Inform the Office of Production Management of the amount, character, and relative importance of materials and commodities needed for civilian use. . . ."

By Special Correspondent

Actions on Metals

WASHINGTON has taken important action on almost every metal of industrial importance. Each action is important to more people than those involved in production and use. Each such action is likely to be precedent-making. Some of the highlights of April actions are summarized here as a guide for the thinking of mining industry executives.

Nickel Inventory—The Bureau of Mines inventory of nickel stocks disclosed little or no hoarding. Apparent consumption is thus interpreted as representing almost exactly actual usage plus some small needed inventory increases. But prices of nickel scrap and nickel alloy scrap have disturbed OPACS Chief Henderson, who says, "Such ridiculous prices are completely unwarranted and have caused speculation and hoarding. . . . We intend to correct this situation . . . adjusting the prices of secondary materials in line with the price of primary materials."

Cadmium Warning—Increasing use of cadmium for plating as a substitute for zinc and nickel has caused appreciable rise in prices. Washington charges profiteering and warns that increased output should increase supply this year appreciably. "If cadmium prices do not return quickly to a reasonable level, the price stabilization division will take drastic action to make them do so."

Tin For Food Cans—Conferences of April between can makers and the Conservation Unit of OPM produced agreement on easy reduction in use of tin by 10 percent for coating of about 95 percent of all tin cans.

Aluminum Dictionary—To guide rulings regarding allocation of primary and secondary aluminum, an elaborate dictionary of uses has been prepared by OPM. The metal producer looks in this book to see just what rating is to be given to any customer's request. Then he knows what percentage of last year's consumption by that individual purchaser is permitted. Thus, a complete classification of secondary, as well as primary, metal users is automatically arranged without reference of individual cases to officials. All of the non-defense uses are given Class B priority. And the percentage of last year's purchases permitted depends on the class, ranging from 80 percent for B2 priorities on new metal down to 10 percent for B8 users. Corresponding allocations for low-grade metal (secondary or other with less than 87 percent Al) are from 100 percent to 50 percent of 1940 purchases.

Magnesium Shortage—The real pressure at the moment for more magnesium is to provide a supply for British use in incendiaries. This is holding up somewhat the further development of magnesium alloy parts for aircraft.

Quicksilver Monopoly—Official Washington is trying to talk down the price of quicksilver. A speed-up of production in Mexico, British Columbia, Peru, and China is reported, in addition to United States output far in excess of all normal peace-time U. S. consumption rates. A reversal of "the vicious spiral of price inflation" is, therefore, forecast.

Enough Bauxite—The Bureau of Mines has officially advised OPM that plenty of domestic bauxite is available if the Emergency should cut off import of this essential raw material from South America. The Bureau's recent survey shows that domestic production is running at least 50 percent above last year. The O.P.M. interprets the Bureau report as follows:

"This survey shows that domestic bauxite production can be multiplied threefold in two months and fivefold in four months, with little new equipment beyond that already at the mines or in construction. A considerable part of this increased production could be obtained by merely changing operations from the one-shift per day basis to a three-shift basis. If shipping were not available, the load could be shifted on to American producers without delay."

Lead Ceiling—The unexpected declaration by Administrator Henderson that a price ceiling on lead was necessary was made April 5. But OPACS did not follow through promptly on the first warning. It is officially believed that if excessive forward buying and stocking up is avoided, there will be no shortage.

Zinc Troubles — The OPACS price schedule No. 3 governs maximum prices for zinc scrap and secondary slab zinc to complete the price regulation on this key metal. Further restriction on zinc

usage was imposed on April 18, when the percentage of metal which must be allocated to the reserve pool was raised from 5 percent to 17 percent of production. The new rule applies for the month of May. Still later in the month a further examination of the zinc supply situation was promised by the Priorities Division of OPM. The results will guide the rules which will restrict the amount of this metal allocated to non-defense uses. In this connection, the recent Bureau of Mines report makes clear the distribution of the 1940 total quantity of zinc rolled according to grades, as follows: brass special, 41 percent; intermediate, 22 percent; prime Western, 16 percent; high grade, 14 percent; selected, 5 percent; and electrolytic, 2 percent.

Tax Plans

PROPOSALS of Secretary Morganthau to raise an additional $3,500,000,000 of Federal taxes beginning soon surprised Washington only in the size of the figure. Initial proposals approximating $2,000,000,000 to $2,500,000,000 have been expected. But apparently all important influences on Capitol Hill are backing the general theory of pay two-thirds of the gross budget as we go further into the Emergency. The willingness of the public to be so heavily taxed seems clearly indicated by the active cooperation of Congressmen generally.

This program may give us, some think, a test of a "no-profit economy." The rates on earnings of corporations are talked in terms that may leave little or nothing for stockholders. Certainly, continuing rise in wage and raw material costs can be expected. With a doubling of the tax bill on industry, expectable for 1942, there will be little taxable income going from corporations to holders of equity securities. What this may do to the income taxes on individual incomes is a question that is being evaded.

There is some quiet grumbling, of course. Surprisingly little of this will have any influence. It is charged by a few that the motive of this heavy tax program is about equally money raising and business control. But certainly a large percentage of the official backers cannot be legitimately accused of the second of these purposes. But whatever the motive, there will be some substantial effect of placing the future of enterprise further under the influence of Washington through the selection of the points at which the new taxation is to bear most heavily.

Ultimate Bottleneck

POSSIBLY copper will furnish the ultimate limit on speed of defense manufacture. That there should be such a bottleneck, whether in copper or some other commodity, is a new thought with OPM executives. Here is the way they seem to view the situation:

When the all-out effort is finally made, we are likely to reach a time when some element of raw material can no longer be supplied in increasing quantity. Take copper as a possible example. We would then have about a million tons of U. S. production, about a half-million tons from South America (the net available in addition to South America's own consumption requirements), and perhaps a hundred thousand tons of secondary. This totals 1,600,000 tons per year available supply.

The rate of copper disappearance at present is over 130,000 tons per month. That is exactly equivalent to the prospective available supply at peak of "possible" production. Next year there will be smaller need of building up process inventories. But the demand for ammunition shells alone will be at least 200,000 tons per year greater in 1942 than now. Thus, we may find that every available pound of copper which the physical facilities open to us can produce for us will not be enough. That surely is an "ultimate bottleneck." (Editor's note: The reader is referred to our editorial "Supply and Demand in Metals," suggesting caution in interpreting current metal statistics.)

Naturally, OPM is not yet facing that extreme situation. But its responsible officials do believe that it has real meaning, perhaps for next year. They know that shutting down of one small light-alloy casting plant in California practically threatened to shut down the entire West Coast aircraft industry. Possibly copper or some other metal of which we simply cannot get more than a certain quantity will provide a comparable final limit on American defense activity.

What then? Obviously, there are two alternatives. First, substitution for this metal in the less essential activities, even those of military meaning. Second, a sort of superhuman effort to expand production facilities beyond the top now thought "maximum." Every mineral-producing industry may sooner or later be confronted with one or another of these alternatives. Washington hopes not; but is not too sure.

Union Discrimination

THE SUPREME COURT has ruled unanimously that a company may not discriminate in its hiring of employees against an individual worker simply because of his union affiliation. Five members of the Court go farther, but in this are opposed by two Justices. The majority argue that N.L.R.B. in enforcing its authority in these matters may both order employment of individuals so discriminated against, or require reinstatement, and may order reimbursement for the back pay lost.

Under this ruling of April 28 the Court set up definite principles which will govern not only Phelps Dodge Corporation, the interested company, but all other employers. It gives even more sweeping authority to N.L.R.B. to prevent that discrimination in hiring which "is twin to discrimination in firing." The ruling says that Congress not only did give the Board this right of discrimination, but also had constitutional authority so to act.

The Court did not undertake to fix details of damages which must be paid by the company through reimbursement of the individuals. It left that to N.L.R.B. But it did point out that the fact that the individuals had sought and found substantially equivalent employment elsewhere did not deny them the right of some reimbursement.

News "Fines"

Defense Lethargy — Washington is going to crack down on some of the industries which do not show any enthusiasm for government orders. Many firms are content to run along at less than maximum rates. If they can do more work that government officials think should be done, they may be forced either to put on more shifts per week or surrender their present activities. The leverage used may be control of raw material supplies. This means that some mining and metal companies may prove to be Uncle Sam's policemen, whether they like it or not.

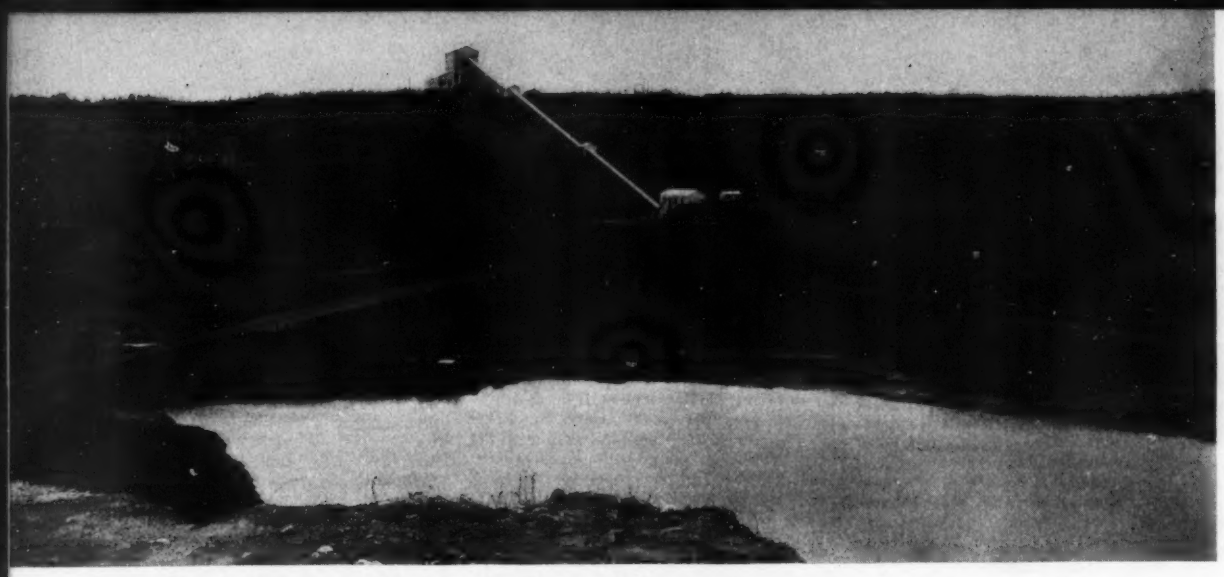
Working Agreement—Donald Nelson, director of purchases, and Leon Henderson, OPACS boss, have announced a working agreement with respect to prices. The Division of Purchases will keep OPACS informed of buying plans, and OPACS will indicate the results of price investigations. This means that Henderson may become price fixer for the purchase unit, still further centralizing authority in his office. This seems to be in line with the President's wishes as well as with the ambitions of Mr. Henderson.

Commerce Bureau—An elaborate reorganization of the Bureau of Foreign and Domestic Commerce was announced during April. All of the commodities divisions have been abolished, including the Minerals Division. Emphasis is now on economic and broad policy questions. Much less attention will be given to individual commodities. Some of the old metal and mineral division staff will remain, but most of them are believed to be on the way out.

Priority Handbook—A full disclosure of the priority policy as of April was published by OPM in a handbook on the operation of the priorities system titled "Priorities and Defense." It published also the priorities critical list as of March 15, 1941. Promised in future editions or by suitable releases are the amendments made from time to time in this list. Such new list is expected monthly, about the 15th of each month. The book also includes the necessary instructions and sample forms showing how both processors and users can manage their priority business.

The Freezing Process — Prices are frozen; they are not fixed. This is a fine distinction of words that has important meaning for any commodity subject to OPACS study. The technique adopted by Administrator Henderson means that by a very simple order the whole trade set-up can be controlled. One effect is to narrow the mark-up between cost and sales realization as wages, taxes, and raw material prices advance. But that's part of the accepted policy of Washington. It is not expected that all the ceilings (either on unions or wages or prices) will hold.

"At the Market" Is Taboo—Certain dealers have been reprimanded by OPACS executives for quoting on goods for future delivery "at the market." Miss Elliott sharply criticized this plan for food, claiming that such quotations were not bona fide and so tended to encourage inflation and price spiraling. Comparable rulings have not yet been made on metals or minerals.



Looking across the Canisteo pit at the concentrator, or washing plant, on its edge and the conveyor line leading up to it from the crushing plant in the bottom

The Canisteo Open Pit Adopts Trucks and Conveyors

High costs with steam equipment at this Mesabi iron mine led to radical changes, with resultant great advantages

W. A. Sterling
District Superintendent
Cleveland-Cliffs Iron Co.,
Hibbing, Minn.

THE CANISTEO MINE, at Coleraine, Minn., on the western end of the Mesabi range, is an irregular-shaped open pit covering about 220 acres. It was opened by the Oliver Iron Mining Co. in 1906 and operated by that company up to and through the year 1925. Approximately 18,000,000 tons of merchantable ore and concentrates was mined and shipped, this exhausting all of the direct-shipping ore and leaving a grade requiring further concentration. In 1924 the mine was returned to the lessor, the Canisteo Mining Co., which held it until 1929, when it was leased to the Mesaba-Cliffs Mining Co. The latter company operated it up to the end of 1938, mining and shipping about 4,000,000 tons of ore from it. When the lease terminated on Jan. 1, 1939, sufficient wash ore remained in the property to produce around 6,000,000 tons of concentrates.

High taxes, high rates of pay, and a gradually increasing mining cost had made the property expensive to operate with the mining methods employed. The high mining cost was due to the following conditions:

1. Stripping was expensive because the waste dumps were so situated that a 5-mile haul was entailed.

2. Track costs were excessive in that there were approximately 15 miles of track to maintain.

3. Ore-haulage costs were high; the haul from the pit bottom was about 6 miles, with a maximum grade of 2½ percent, and as the pit deepened this haul lengthened as the number of switchbacks increased.

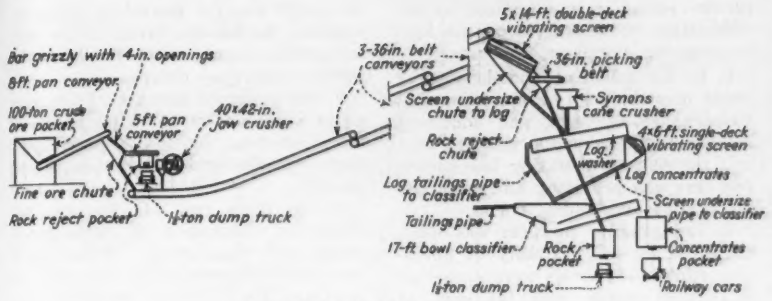
4. The orebody was irregular, and to grade the ore properly for shipment it was necessary to open and maintain several loading places, which involved the constant switching of shovels and loading tracks. The track extensions often required extensive rock work.

5. Concentrating costs were high because, in addition to the necessity of making a long haul for the crude ore, the water supply for washing had to be augmented by pumping from the pit. This meant a lift of about 350 ft. through approximately 6,000 ft. of pipe line.

6. The general open-pit expenses, including those for pumping and general pit maintenance, were excessive unless a large tonnage of ore was mined.

7. Costs of repairs on the locomotives and cars which were made during the winter were very high, inasmuch as the provision of an adequate supply of crude ore required the use of six locomotives and 24 dump cars. This equipment was used in both the mining and the stripping, and the necessary repairs were quite extensive.

After the Mesaba-Cliffs company terminated the lease, the Canisteo Mining Co. decided to operate the property itself. A study was made of the existing conditions with a view to developing a more economical method of mining. Electric haulage, using pilot cars and operating on steeper grades than would be used with steam haulage, was considered. A combination of truck and steam equipment, in which the material would be hauled by truck to a pit pocket where it would be transferred to dump cars and delivered to the concentrator, was also investigated. The Canisteo's mine problems seemed best solved by selecting a combination of truck haul with conveyor-belt delivery from the pit bottom to the top of a concentrator situated at the edge of the pit, for the following reasons:



Flowsheet of Canisteo washing plant

1. Lands adjacent to the various areas requiring surface stripping were available for waste-dump sites so that waste material would have to be hauled only a short distance by the trucks.

2. The concentrator could be moved to the edge of the pit and a conveying system installed from the pit bottom up to the plant without tying up any minable ore.

3. An excellent site for a tailings basin was available within half a mile of the new location proposed for the washing plant.

4. There were sufficient worked-out areas in the pit for the disposal of all pit rock and any rock which would be removed in the crushing plant in the pit. These areas could also be used for dumping waste rock and paint-rock stripping in the pit bottom.

5. The large inflow of pit water would furnish an ample supply for all concentrating purposes.

6. A truck operation would not only make available isolated bodies of ore and the deposits formerly tied up in track benches, but it would greatly simplify grading problems.

A plan was adopted early in the spring of 1939 and an arrangement was made with the Cleveland-Cliffs Iron Co. to act as "operating agent." As there was not sufficient time to effect a complete change-over, it was decided to operate during the 1939 ore season with a combination of truck haulage and delivery by steam equipment. The ore was hauled from the power shovels to a transfer pocket in the pit, loaded into dump cars, and hauled by steam to the washing plant. Three four-car trains and six trucks were required for gathering and delivering the ore. Six Euclid 15-ton rear-end dump trucks, a D-8 Caterpillar tractor, and a "Road Patrol" were purchased, the latter two machines being used in building and maintaining roads with material at hand. This method of operation worked out well and demonstrated the economy of truck haulage in this type of mining.

Following the 1939 ore-shipping season, work was started to complete the change-over to the conveyor system. The railway tracks were removed from the property and the concentrator was moved to its new location near the edge of the pit.

A new tailings pond was located and encircled with a dike 15 ft. high and 18 ft. wide at the top, using surface material which was hauled by truck from adjacent stripping operations. The equipment installed for handling the tailings consisted of 800 ft. of 16-in. pipe, through which the tailings were flumed to a 12-in. Hydro-Seal pump. From here they were forced, against a 20-ft. static head, 1,700 ft. through a 12-in. pipe line into the tailings basin.

A 10,000,000-gal. reservoir for clean water was provided adjacent to the mill and water was fed by gravity to pumps placed on the ground floor of the concentrator. Water was pumped to the reservoir through a 16-in. pipe line from the pit by means of a 1,500-g.p.m. high-pressure pump, and through a return line from the settling basin, using a 2,000-g.p.m. low-head pump.

A 100-ton concrete pocket and the crushing plant were erected in the pit. They were located on the pit floor in a rocky worked-out area and connected with the concentrator by a conveyor system 1,000 ft. long. The latter comprises a 36-in. belt conveyor built on an 18-deg. slope and housed in a steel gallery. It was constructed in three sections with two transfer houses.

The main haulage roads are 50 ft. wide, one leading to the pit pocket from the south side and one from the east side of the pit. They were built up with material at hand, using taconite and paint rock for the main fills, and dressed with a rubbly material. The high fills were built up in low lifts, the material being compacted under truck traffic, thus avoiding any appreciable settlement later.

In addition to the six trucks, the tractor, and the grader, which had been purchased previously, two 85-B Bucyrus-Erie shovels with 3½-cu.yd. welded dippers, two Bucyrus-Erie 27-T combination blast-hole and structural drills, and a road sprinkler, were purchased. The latter is used to lay the dust and to help maintain a smooth, hard hauling surface.

The preparatory work was finished late in May, and the 1940 ore season was started May 29, using four to five 15-ton trucks, hauling from two shovels. A 600-ton-per-hour supply of crude ore is trucked to the pit pocket, the haul averaging 2,400 ft., with a maximum grade of 8 percent.

Dumped into the 100-ton pocket, the crude ore is carried by an 8-ft. pan conveyor to a 4-in. grizzly. The undersize from the latter is fed through a chute direct to the 36-in. belt conveyor. The oversize falls onto a 5-ft. pan conveyor, leading to a 40x42-in. primary jaw crusher. The large rock is scalped from the 5-ft. pan conveyor and dropped into the rock chutes from which it is hauled by truck to adjacent waste dumps.

Oversize ore material is crushed to 4 in. in the primary crusher and fed through a chute to the 36-in. belt conveyor, falling upon a cushion of undersize. By means of the conveyor it is delivered 1,000 ft. on an 18-deg. slope to the top of the washing plant, passing through the two transfer houses mentioned. At the top of the mill it is dumped onto a 5x41-ft. double-deck vibrating screen, the undersize going directly to log washers. The oversize is carried on 36-in. picking belts, from which additional rock is removed by hand-picking, to secondary cone crushers which reduce the material to ¾ in. and then feed it into the log washers.

The log product is passed over 4x6-ft. vibrating screens, where it is deslimed, and is then delivered directly into the concentrate bin. The log trailings and the tailings from the deslimming screens are carried to 17-ft. Dorr bowl classifiers for further concentration. The classifier product is taken by 24-in. cross conveyors to the concentrate bin, where it is mixed with the log product and delivered directly

Truck dumping into hopper of crushing plant at foot of conveyor line

Photo by courtesy of Link-Belt Co.

into ore cars for shipment. The classifier tailings are carried through the tailings disposal system to the settling basin.

The operations at the mine for the 1940 shipping season were completed early in October, after yielding nearly 500,000 tons of concentrates.

The new method of mining worked out well in a smooth, continuous operation, and our anticipations were found to be actually bettered. At this particular property the following advantages of gathering by truck and delivering by conveyor belt, as compared with gathering and delivering by steam locomotive, were demonstrated:

1. With a short haul to adjacent dumps and with a lower initial expense, surface stripping costs were reduced. Where taconite and rock had to be stripped in the pit bottom a further reduction was realized by the elimination of the long, expensive haul to stripping dumps on the surface.

2. In the gathering and delivery of crude ore, the cost of operation and maintenance of truck and conveyor, including all road costs, was less than half the cost of operating locomotives and cars and providing and maintaining hauling and loading tracks.

3. The grading problem was much simplified by the flexibility of operation afforded. Shovels were moved on established roads, and the cost of shifting a truck operation was but a fraction of that required where locomotives, cars, and loading tracks were involved.

4. Costly rock work was reduced by elimination of rock cuts for track grades and through lower pit-rock costs. When rock was encountered in mining, it could either be cast aside in the rocky area, or hauled by truck to adjacent worked-out areas in the pit, saving the long, costly haul to the surface stripping dumps.

5. An increased tonnage of ore was made available by the elimination of track benches. Isolated deposits and deep orebodies could likewise be mined readily.

6. The labor cost per ton was reduced by elimination of large track gangs and shop crews. With fewer men and with practically every man a producer, the operation could be conducted on a small-scale, as well as a large-scale, program.

7. Maintenance cost for the motorized equipment was much less than that for locomotives and cars.

In short, the new method of mining proved to be simple, flexible, and economical and especially adapted to a pit of the type described.

Trend Toward Metal-Mine Electrification

Sectionalization and protection system will localize electrical breakdowns and safeguard expensive mining machinery

H. P. Chandler
Development Engineer
Ohio Brass Company
Mansfield, Ohio

IN THE PAST FEW YEARS there has been a noticeable trend toward the use of electrical power underground in metal and nonmetallic mines. To a certain extent this can be attributed to the development of electrically powered mining equipment for these operations. The increasing accessibility of transmitted power and the fact that hauls are becoming longer are contributing factors.

Electrification with d.c. power, where its use is decided upon, requires a careful analysis of potential electrical loads and future development of the mining operations. Ways and means of segregating and localizing the various activities making up the entire electrical system should be carefully studied. Coal mines which, almost without exception, employ d.c. electrification have become more and more conscious of the importance of making such an analysis of their electrical systems. The larger operations and a great majority of the smaller ones in the bituminous and anthracite fields have standardized on electrical plans and expansion programs which provide primary and secondary sectionalizing points throughout the mine, so that an electrical breakdown is localized.

When one realizes how drastically an electrical breakdown which is not isolated can effect the production of a mine, there remains not a shadow of doubt that some means of sectionalization should be incorporated into the electrical system. In the past, before sectionalizing became such an important aspect of coal-mine electrification, electrical breakdowns frequently stopped production for an entire shift. When viewed in the light of such occurrence, the cost of even the most expensive and all-encompassing type of sectionalization is a drop in the bucket in comparison with the tonnage setbacks which can occur.

Generally speaking, sectionalizing in electrified mines can be classified in three ways: (1) where trolley wire and track are taken into or in close proximity to the working places; (2) where conveyors, loaders, scrapers, or sleds are used in the working places and for some distance to a point on or above the main haulage system; and (3) where conveyors, loaders, scrapers and sleds are used in gaseous or explosive atmosphere.

All of these classifications of sectionalization refer to the area extending from the working section to the main haulageway or the main ore-gathering point. In all three cases the same type of main line or primary sectionalization can be used.

In the first place, the substation or main source of mine electrical power should be segregated from the entire operation by a standard type of substation circuit breaker. As the point of operations gains distance from the substation, each main line or each level should be sectionalized by means of a circuit breaker of the time limit type. The load in the particular main section involved should be carefully figured. Every fan, every pump, every locomotive, and every piece of mining equipment should be taken into consideration in setting the "breaker."

This is highly important, for many mines have had sad experiences with circuit-breaker protection when small and more or less inconsequential pieces of electrical equipment were not taken into consideration. The breaker should be set to handle the peak electrical load for a predetermined time, usually varying from nine to twelve minutes.

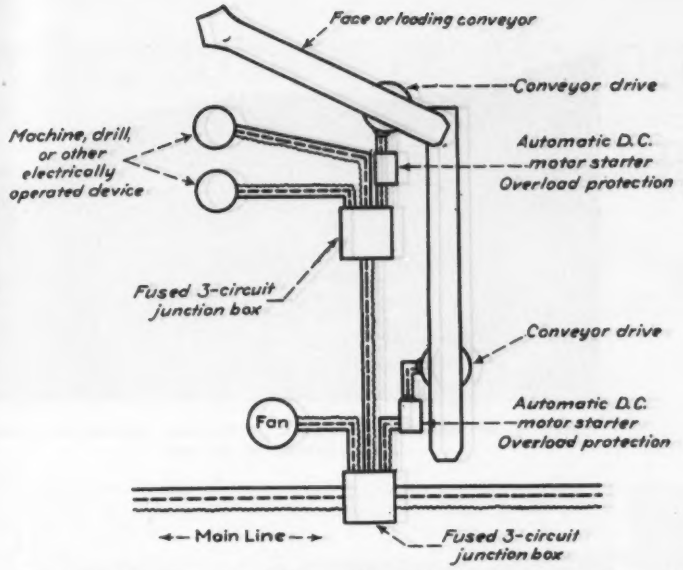


Fig. 1 . . . Theoretical sectionalization of an area using conveyors, scrapers and similar equipment

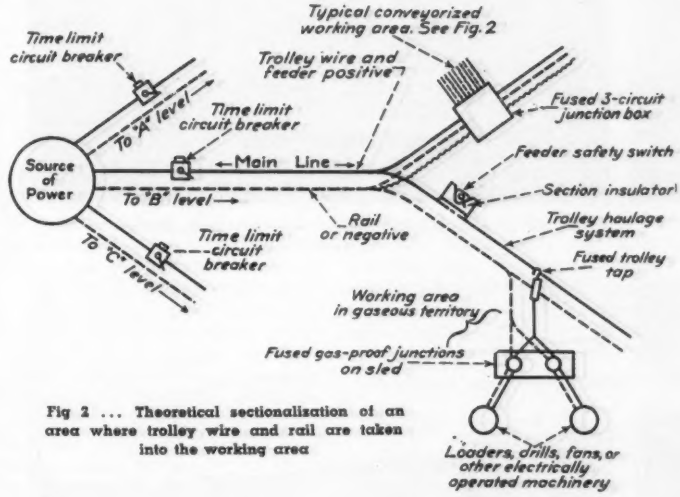


Fig 2 ... Theoretical sectionalization of an area where trolley wire and rail are taken into the working area

This will provide the necessary protection in the particular level or main section involved. If possible, it is well to have the "breakers" for all levels or all sections located at a central point, so that section which is in difficulty can be immediately known.

Where it is not desirable or not absolutely necessary to use a circuit breaker to indicate and eliminate a primary breakdown, a safety feeder switch, operated manually, can be used to advantage. This switch should have sufficient capacity to handle the load in the particular section involved and should take care of a high-capacity current with safety both to operator and switch. If trolley wire is run in combination with feeder, this type of switch can be installed in combination with a section insulator placed in the trolley wire.

Secondary sectionalizing points are usually placed where power is taken from the main line to a working place. This secondary sectionalizing device may be in the form of a multiple junction box with fuse protection for each of the circuits or it may be in the form of a fused trolley tap which is simply hooked to the contact or trolley wire on the end of the trailing cable which leads into the working area. The cable from the fused trolley tap may lead to the motor of a cable-reel locomotive or it may lead to an open-type junction or distribution box with further fuse protection for each of the circuits.

If the working area is in a gaseous or explosive atmosphere (rare in metal mines) the cable from the fused trolley tap or junction box on the main line may lead to a sled supporting one or more gas-proof fused junctions. This type of junction is, of course, airtight and incloses a switch, with fuse protection for the circuit which leads to the mining machine so protected.

By sectionalizing and protecting the power system inside the working place with either an open-type junction box or gas-proof junction boxes, we are able to keep the rest of our equipment in operation should one of the loaders, drills, fans, or scrapers succumb to a power failure or breakdown. In other words, the producing units in the mining operation go right ahead with their work regardless of power breakdowns in their immediate vicinity. This means that the working area concerned may still function at 50 or 75 percent of its efficiency even though a power failure has occurred.

A secondary purpose of the fused trolley tap is the elimination of cable overloading and accompanying burnouts. Fused trolley tap protection has even been incorporated in locomotives where the tap is placed in the cable circuit leading from the current collector to the motor.

In working sections where conveyors are used to transport ore to the loading point a junction box at the main line sectionalizing point and also at the working place can be used. The junction box at the main-line point may have three circuits emanating from it, one going to a small blower fan which ventilates the section, one going to a motor starter which operates the conveyor leading from the working place to the main loading point, and the last cable going to a junction or distribution box, previously mentioned, within the working section. All of these circuits are completely fused within the junction box on the main line.

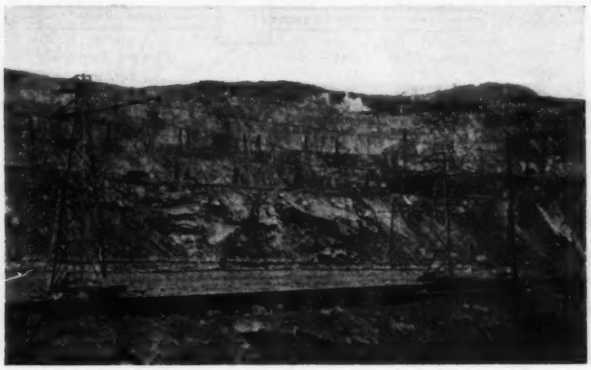
The open-type junction or distribution box within the working area also provides fuse protection for each of the circuits which emanate from it. These circuits may go to operate a motor starter on the subsidiary conveyor, or any other machinery which comes into the picture. And so electrically operated equipment may be completely sectionalized and protected as to each individual item. Even the automatic motor starters which operate the conveyors, fans, or pumps provide sectionalization protection within themselves, in some cases fused and in some cases thermal overload protection.

The endless possibilities of sectionalizing the electrical system of a mine can be imagined by any one familiar with the various aspects of mine operation. In sectionalization is to be found the long-sought means to an end—a comparatively inexpensive means which will keep ore flowing to the mill, which will protect expensive equipment from overloads and burnouts, and which will permit the entire operation to function without being slowed down or without even pausing for a normal electrical breakdown.

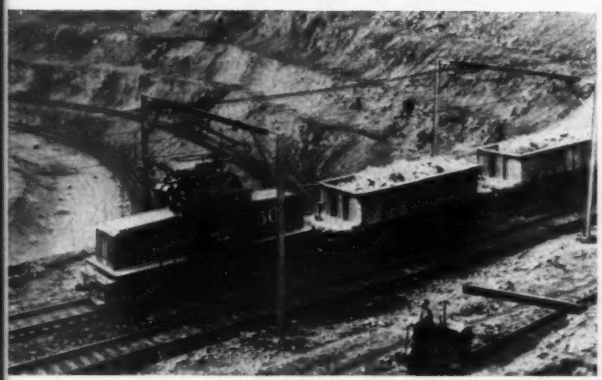
Nevada Consolidated Electrifies Its Chino Pit

Some of the electrified pit benches. A 4½-cu.yd. railroad-type electric shovel working on pit floor

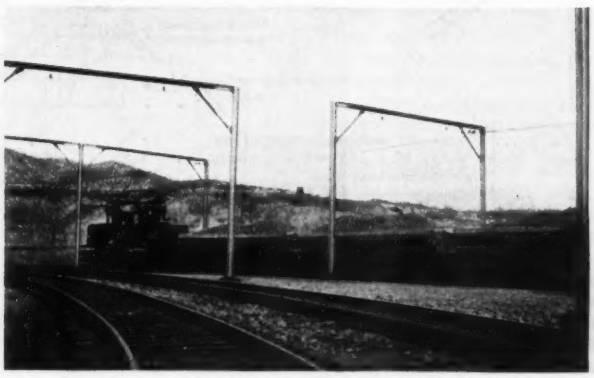
General view of newly electrified Chino pit at Santa Rita, New Mexico



Some of the electrified benches vary in height, but are 42 ft. wherever possible



An 85-ton G. E. electric locomotive and 40-ton ore cars at pit entrance



An 85-ton G. E. electric trolley locomotive and 30-ton waste side dump cars leaving pit

A 5-cu.yd. Marion full-revolving electric shovel loading waste into 30-ton side-dump cars.

Expansion of Mining in Bolivia Awaits Mechanization

With no unemployment, the future of the industry, with increased output per man and higher wages, must depend on improved mechanical appliances

P. H. Reagan
Consulting Mining Engineer
LaPaz, Bolivia

BOLIVIA'S mineral exports increased greatly in 1940, for several reasons: (1) Return to power of a constitutionally elected civil government. (2) Reduction of taxes and of the amount of forced delivery of foreign exchange to the government. (3) Freedom in the exportation of tin, under terms of the International Tin Cartel. (4) Improvement in demand and prices for the strategic minerals which are bountiful in Bolivia.

It is interesting that, in Bolivia's case, the first two items above listed had a greater effect in improving production than did the last two. During the past ten years Bolivia's mineral production has been regulated by political forces and taxation problems rather than by world economic conditions. The present government has studied the mining industries' problems and reduced taxation so that mining could advance. There still remain many improvements, but the important fact is that the government is willing to cooperate with the industry and progress is being made.

The recent agreement between the United States Government, represented by the Metals Reserve Co., and the Bolivian Government, representing certain Bolivian tin producers, assuring the sale of the Bolivian tin to the United States during the next five years, has had a salubrious effect upon the industry. This agreement is for 18,000 tons fine tin yearly and represents most of Bolivia's production excepting the 22,000 tons or more produced by the Patiño group. Patiño's production had previously been contracted for by the English tin smelters for a period of ten years. The agreement with the United States assures Bolivia an outlet for its tin ores should the English tin smelters be damaged by the air raids over England. It also assures the Bolivian tin industry a market for the next five years, thus allowing many of the producers to undertake plant extensions which otherwise might not have been considered.

Prior to the present world war most of Bolivia's low-grade dirty tin and tungsten concentrates were shipped to Belgium, Holland, or Germany. Excepting Cappers Pass tin smelter, the English plants treated only the high-grade concentrates. The Bolivian producers of low-grade concentrates have found difficulty in discovering other markets since the closing of the ports to the Continental smelters. This has resulted in the accumulation of large tonnages of this class of material at the Chilean ports. The mining companies did not have funds, with these large tonnages of concentrates unsold, to undertake the mechanical improvement required nor for other plant expansion. This general shortage of working capital in Bolivia likewise prevented some of the non-producing companies from starting operations.

Problem of Foreign Exchange

Foreign exchange has presented another serious problem. Since the tin was shipped to England for smelting, this tonnage was paid for in sterling. It has been very difficult for the mining companies to dispose of these sterling funds so that dollar proceeds would be available for the purchase of machinery and supplies. Under the present war conditions, very little in the way of mining supplies is available for export from England. The Central Bank of Bolivia has accumulated over one million pounds sterling which it cannot exchange for dollars. This has prevented the mining industry from undertaking new improvements. It is hoped that the new contract with the United States will not only provide the dollar exchange so badly needed but also will allow the accumulation of low-grade tin concentrates to be sold, thus providing funds for new expansion.

During the last quarter of 1940 the Japanese became important purchasers of tungsten and antimony concentrates. This suggests that Japan is buying for third parties rather than for herself, since China is an important producer of these two minerals, especially of concentrates containing less impurities and of a kind more readily adaptable to the Japanese smelters and refineries. In most cases Japan is offering higher prices for dirty concentrates than the United States is offering for clean concentrates.

Unemployment is non-existent in Bolivia. The demand for labor at the mines has absorbed all of Bolivia's surplus labor. Future expansion of the mining industry will have to be based to a greater extent upon mechanical devices and improved mining and milling methods, which will allow the present labor to produce more. Present wage scales are low, when converted into foreign currency. Considering the efficiency per man-shift, labor in Bolivia cannot be considered as cheap labor. Through the installation of machinery, teaching the workmen how to care properly for and operate this machinery, production per man-shift can be improved, and the workmen will be worth higher wages. This trend has already been noted at the Llallagua mines of the Patiño group, where wage increases based on mechanical operations were introduced last July.

In December the United States Geological Survey started its study of Bolivian strategic minerals. It is hoped that this friendly cooperation between the United States and Bolivia will continue, and that the United States, after learning more regarding the ability of Bolivia to supply her with these vital minerals, will arrange her economy so that Bolivian strategic minerals will be used to a greater extent.

Tungsten and antimony are two of the most important strategic metals, and they both occur abundantly in Bolivia. About 50 percent of the tungsten and practically all the antimony is produced and milled by hand methods. Now that additional hand labor is no longer available, if production of these two minerals is to

increase, capital must be invested in mechanical plants. The producers have been loath to do this, as they have felt that they did not have a stable market. The drastic collapse of the tungsten market after the World War of 1914–1918 caught many of Bolivia's producers just starting new plants. They have stated that they would not be caught that way again. However, if the United States and the Bolivian Government could arrange contracts for these two minerals, similar to the tin contract, the production of these two minerals could probably be doubled within the next two years. Bolivia is an important source of these minerals and the United States could well afford to stimulate their production as an American and Western Hemisphere defense measure.

Export statistics for mineral shipments for 1940 show a decided increase over former years. See Table I.

Tin Production Increasing

Tin production for the first quarter of 1940 was at the rate of about 28,000 tons of fine metal yearly. In April the Bolivian Government agreed not only to peg the forced delivery of foreign exchange at 42 percent of the sale price, but also introduced other modifications which practically eliminated the drastic June 7 decree of 1939. For this the tin miners agreed to produce at the rate of 36,000 metric tons of fine tin yearly. Production immediately began to increase, as the mining companies, in anticipation of this agreement, had been preparing their plants for greater production. This improvement continued, and by the end of 1940, production was at the rate of approximately 43,500 tons of fine tin yearly. If the present cooperative spirit continues between the government and the mining companies, and there are no economic reverses, it is very possible that tin production in 1941 will again reach the 1929 peak of approximately 49,999 tons of fine metal. As there were no accumulated stocks of tin concentrates in Bolivia at the beginning or the end of the year, the 1940 exports represent true production.

The most important development among the individual mines was the return to capacity operation of Llallagua, the world's foremost vein-tin mine. Since 1931, due to limitations imposed by the International Tin Cartel, the Chaco war, and lack of labor, this mine has been producing at less than 50 percent of capacity. Many had assumed erroneously, because of this reduced production, that the mine had reached its zenith and was in decline. A new operating program was approved by the directors in early 1940 and the productive capacity of the mine was rapidly increased. By the end of the year, both mine and mill were operating at near capacity, production being at the rate of 1,400 metric tons of fine tin monthly. With ample proved ore reserves, Llallagua will continue to be the backbone of Bolivian tin production and the world's premier vein-tin mine for years to come.

A new mill has been completed at the Tanapaca tin mine of the International Mining Co.; Fabulosa Mines Consolidated has enlarged its Milluni mill; and the Bolivian Tin & Tungsten Co. (Patiño) has completed the designs of and ordered a new sorting plant to be installed at the main haulage tunnel of the Huanuni mine. Empresa Minera Santa Fe has been studying the installation of a mill. The Santa Fe mine is the one new tin mine that has been discovered in Bolivia in the past decade. It is located near the Morococala mine of the Cia Minera de Oruro and produces tin ore from small and narrow but very high-grade veins. Mining and milling are entirely by hand methods.

Bolivian Tin & Tungsten Co. (Patiño) has exercised its option and purchased the Canutillo mine near Potosi. It has been carrying on development work at this mine for the past year. This is the first sale of a major tin mine in Bolivia since 1932.

The tin contract with the United States calls for the delivery of certain tonnages of different classes of tin concentrates. Table II, supplied by the "Direccion General de Minas," shows the tin exports by classes for the first ten months of 1940.

Tungsten Needs Stable Market

Tungsten is a strategic metal which occurs abundantly in Bolivia. Lack of a stable market has in the past prevented capital from entering this business. Nevertheless, over 55 percent of the Bolivian production comes from four companies which have installed modern milling plants and are operating on a permanent basis. They are: International Mining Co. (W. R. Grace & Co.); Cia Aramayo de Mines en Bolivie; Bolivian Tin & Tungsten Co. (Patiño), and Inslee & Easley. The Banco Minero, which is the government ore-buying agency, accounts for the balance and is buying from many small producers, all of which are operating small hand mills. Many of these properties, if properly equipped with mechanical mills, after a short development program, could be developed into mines having a productive capacity of 10 to 50 tons fine WO_3 monthly. Although they have no blocked-out ore reserves, many are excellent prospects, and with adequate capital could soon be made into excellent mines.

Exports of fine metal in metric tons for 1940, by companies, were:

Banco Minero de Bolivia	944
International Mining Co. (Grace)	600
Cia Aramayo de Mines en Bolivie	489
Bolivian Tin & Tungsten (Patiño)	190
Soc. Empresa de Estaño de Araca (Patiño)	113
Soc. Minera Juliana	97
Easley & Inslee	77
Total	2,510

The International Mining Co. (W. R. Grace & Co.) is Bolivia's principal tungsten producer, accounting

Table II—Classification of Bolivian Tin Exports by Grade (a)

	55% Sn and Up		35% Sn to 55% Sn		25% Sn to 35% Sn		Under 25% Sn		Total 10 Mo.		Total Year
	% Sn	Fine Metal	% Sn	Fine Metal	% Sn	Fine Metal	% Sn	Fine Metal	% Sn	Fine Metal	Fine Metal
Patiño Mines & Ent	63.2	8,701	....	.....	....	.....	....	.....	63.2	8,701	13,639
Bolivian Tin & Tungsten Co	60.3	1,815	....	.....	28.5	255	....	.....	52.6	2,070	2,410
Cia. M. y A. Oploca	60.6	1,321	....	.....	....	.....	....	.....	60.6	1,321	1,676
Soc. Emp. Estaño de Araca	64.0	775	....	.....	....	.....	....	.....	64.0	775	936
Total Patiño group	62.4	12,612	....	.....	28.5	255	....	.....	61.0	12,867	18,661
Cia Minera de Oruro	....	.....	53.5	3,758	30.0	495	21.1	567	42.6	4,820	6,057
Cia Unific. de Potosi	57.0	2,059	....	.....	28.3	465	24.5	398	42.6	2,922	3,524
Total Hochschild group	57.0	2,059	53.5	3,758	29.2	960	22.4	965	42.6	7,742	9,581
Cie Aramayo de Minas en Bol	56.9	2,475	....	.....	....	.....	....	.....	56.9	2,475	2,963
Banco Minero de Bolivia	....	.....	52.7	1,471	29.8	392	19.0	430	36.0	2,293	2,701
Empresa Min. Sta. Fe	56.0	159	....	.....	28.6	186	23.1	90	32.8	435	566
Fabulosa Mines Cons	....	.....	52.3	354	25.0	57	24.0	21	43.6	432	541
Bol. Int. Mining Co	58.1	336	....	.....	....	.....	....	.....	58.1	336	376
International Mining Co	66.1	166	....	.....	27.2	133	(b) 19.5	10	(b) 39.1	309	428
Other medium mines	58.7	1,298	49.0	305	29.0	136	20.0	442	39.5	2,181	2,714
Total medium mines	58.9	1,959	50.7	659	27.9	512	20.5	563	40.1	3,693	4,625
Total Bolivia	60.7	19,105	53.1	5,888	28.9	2,119	21.0	1,958	49.1	29,070	38,531

(a) Ten months exports 1940, data from Direction General de Minas La Paz. Metric tons.
(b) Mixed tin-wolfram ores refined to 66% Sn concentrate in the United States before delivery to tin smelter.

for approximately 25 percent of the total exports. A 75-ton mill was placed into operation early in 1940 and is now operating at approximately 150 tons of ore daily. Plans are under way to increase the capacity of this plant to about 300 tons of ore daily, mainly through additional power and mine equipment. In addition to tungsten this mine also produces tin in the form of a tin-tungsten concentrate. Prior to the war, this mixed concentrate was sold in Europe. An experimental plant was installed in Philadelphia, Pa., in the fall of 1939, and it now appears that a satisfactory flowsheet has been evolved for the separation of the two minerals.

Socieded Empresa de Estaño de Araca (Patiño) has been carrying on deep development work on its tungsten deposits for the past two years. The lowest tunnel is located about 4,800 meters above sea level, the outcrops being some 300 meters above. Plans are now being studied for the construction of a mill and power plant capable of producing about 50 tons fine WO_3 monthly. During 1940 production was approximately 10 tons fine metal monthly.

Other Metals

Antimony — Antimony production for 1940 showed only a small increase as compared to 1939. This business is based on hand labor, crude hand mills, and limited capital. Production depends to a great extent upon the discovery of large pockets of high-grade stibnite. Approximately 75 percent of the Bolivian production is sold through the Banco Minero. The Tupiza area in southern Bolivia was the greatest producer.

Copper—Cia. American Smelting Boliviana Ltda completed its new copper mill at Corocoro and is now exporting about 500 tons of fine metal monthly. This company accounts for 75 percent of the Bolivian exports. Huanchaca silver-lead-zinc mine ships a small tonnage of copper as part of its lead concentrates.

Gold—Exploration work has continued at the Tipuanu and Guanay placer deposits by the Cia. Aramayo de Mines en Bolivie. Plans are now being made for a power plant and dredge for the Guanay deposit. The Bol-Inca company has renewed its drilling operations on the Kaka River below Guanay. Exploration work is said to be very encouraging and it is possible that a dredge may be installed toward the end of 1941 or the spring of 1942. Operation of the Vilaque tin-gold placers, located on the west slope of Hyuana Potosi near LaPaz, has been resumed. This work is being carried on by hydraulic methods, seven monitors being operated. This area may soon prove a large and important source of Bolivian placer tin, as well as gold. The tin concentrates are very clean and assay about 55 percent Sn.

Silver-Lead-Zinc — Silver production comes mainly from the Huanchaca silver-lead-zinc mine, the Aramayo silver-tin mines, and the Oruro tin-silver mine. Due to the lower price of silver and the higher price of tin, these last two companies in 1940 concentrated their production upon tin. The Huanchaca Company of Bolivia (Hochschild) produced 70 percent of the Bolivian silver exported in 1940.

Lead is the one metal that has shown no price advance during the present war. This has resulted in the lower production of lead during the past year. The Huanchaca mine produced 50 percent of the Bolivian lead exports, exporting about 1,000 tons of lead-silver concentrates monthly. These concentrates, which formerly were sent to Germany, are now being sent to smelters in the western United States. In the past the American smelters have refused this class of concentrate, because of the high antimony content. Banco Minero is the other principal lead exporter, its shipments representing the combined production of many small producers. The Tupiza area in southern Bolivia furnished the bulk of the Banco Minero exports, the concentrates coming from small mines operated by hand labor. These concentrates assayed about 70 percent Pb, carry only a few ounces of silver, and were exported to Argentina.

All of Bolivia's zinc exports came from the Huanchaca silver-lead-zinc mine. The 1,500 ton flotation mill operated at capacity most of last year. The zinc concentrates, which formerly were shipped to Belgium, are now being shipped to the western United States.

Non-metallic Minerals — The sulphur deposits along the Bolivian-Chilean frontier are now being worked and are producing a large tonnage of high-grade sulphur. The Bolivian government is studying means of installing a modern reduction plant at these deposits.

Asbestos and mica appear for the first time on the export list, the asbestos coming from deposits located between Cochabamba and Santa Cruz.

Improvements in Technology

The absolute lack of hand labor and the improved demand for metals are now forcing the Bolivian mining industries to increase their use of mechanical devices. In the smaller mines this is reflected in the addition of compressors and air drills; in the larger mines by the addition of diamond drills, mechanical muckers, detachable drill bits, and automatic drifters. Bolivia offers a fertile field for increased mechanical mining methods. In the larger mines, where mechanical equipment is being used, the efficiency per man-shift in the mine is from one-half to one ton of ore.

Stoping methods are the conventional shrinkage, incline cut-and-fill, and cut-and-fill systems in the larger mines and gouging in the smaller prospects. Fabulosa, at its Milluni mine, is using sublevel caving. At Llallagua and Huanchaca the mining of old fills has received considerable attention.

Completion of the shaft-sinking program at Huanchaca calls for special attention. Two shafts have been sunk from the 536-meter level to the 615-meter level in the footwall of the vein. This work was done against a flow of hot water, 65 deg. Centigrade, about 1,300 g.p.m. Large pockets of gas were encountered. This work was started in 1937, and the successful completion again demonstrates the ability of the American engineers who laid out and started the project.

Table I—Metric Tons Fine Metal Exported

Metal	1937	1939	1940
Tin	25,531	27,648	38,531
Zinc	11,529	7,768	12,205
Antimony	7,127	10,053	11,808
Lead	18,289	14,125	10,933
Copper	3,693	3,957	6,660
Sulphur	.....	.....	4,082
Tungsten	1,081	2,002	2,510
Silver	294	225	175
Asbestos	.....	.....	70
Bismuth	31	8	19
Mica	.....	.....	1
Cobalt	.....	.....	2
Gold	0.1	0.3	0.4
Selenium	.....	.....	0.1

Tin and tungsten milling are effected by gravity methods. Although some experimental work was carried on last year on the sink-and-float method, no modifications were introduced into general milling practice. At Llallagua the mill heads were dropped from 4 percent Sn to 3 percent Sn, but mill recovery, working at capacity operation, was maintained at 80 percent. At the Tanapaca plant of the International Mining Co., a 70 percent recovery is being made from a 1 percent Sn ore.

Since the signing of the tin contract with the United States the cleanliness and the grade of the tin concentrates has been examined closely. The Platiño group, which produces 60 percent of the clean high-grade Bolivian concentrates and 50 percent of the total Bolivian tin production, is not a party to the contract. The other companies are now producing a greater tonnage of low-grade tin concentrates than they will be allowed to ship under the terms of the contract. It is necessary, therefore, that these companies improve their milling methods in order that they may produce a larger tonnage of the clean high-grade tin concentrates.

Calculation of Gold Recovery From Cyanide Solutions

Notes on practice in two precipitation plants with respect to sampling, assaying, and measuring tonnage treated

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EVERY cyanide operator has at some time or other been faced with the problem of making precipitation calculations check the fine gold content of the bullion recovered from clean-ups. A correct estimate of gold recovery from day to day is obviously important if a plant is to be operated to the best advantage. The following notes of plant practice show that such estimates can be made to agree closely with actual production. Special equipment is not necessary to accomplish this, but an impartial survey must be made of the variables involved in the calculation. The principal variables are measurement of daily solution tonnage, solution sampling, and solution assay methods.

In some plants the method of estimating solution tonnage is inaccurate and in many instances there is a tendency on the part of operators to apply factors to daily precipitation estimates which are based on previous bullion recoveries. Likewise, sampling routines often take a great deal for granted and the method of assaying the solutions is rarely investigated for possible errors. The last mentioned factor, partly because of the seeming simplicity of the solution assay, can be a source of cumulative error that may grow into a serious discrepancy over the usual clean-up period of a week or so.

The following methods of tonnage estimation are listed principally to illustrate the large amount of work that has been done to arrive at a satisfactory solution of this difficult problem. Without question this variable is the one that generally introduces the most error into the accountability calculation.

When a plunger-type pump is used in the precipitation plant the tonnage can be, and often is, approximated from the pump speed and piston displacement on the assumption that these are constant quantities. The assumption would be valid provided the head against which the pump worked were to remain constant. In practice the head on the pump increases more or less regularly as precipitate accumulates in the filters, and a tonnage estimate based on a simple displacement calculation is rendered unreliable due to slip of solution in the pump cylinders. A flat-belt drive is also likely to result in a variable pump capacity, because the belt slippage increases with the pump head.

The use of a tilting launder which discharges alternately to sump tanks that are calibrated for volume is an old and reliable method, but the device may prove cumbersome for high solution tonnages. The trend in modern practice is to maintain high ratios of precipitation tonnage to ore tonnage.

Venturi meters and patent solution meters generally give good results, but they require frequent calibration and cleaning, due to the deposition of dissolved salts from plant solutions.

Contracted weirs of various sections are the most commonly used, and abused, of all measurement devices. Their accuracy is not rated highly as a rule, but they *can* be made to give reliable results if they are properly constructed and are used with an understanding of their limitations. Weirs were used in both plants the practices in which are described below.

As a rule it is easy to take a representative solution sample from any part of a cyanide plant, and the number of instances of faulty sampling in practice is surprising. Accurate sampling in connection with the precipitation calculation is especially important, and the device sketched in Fig. 1 has the essential features for obtaining a representative sample of solution. It has certain limitations, however, and must be used with these in mind.

There is little relation between the slope of the wire cutter and the volume of solution that drips into the sample container. Therefore, to obtain a volume of sample that is proportional to the main flow of solution, the sample discharge pipe must be regulated to discharge a *constant* amount for any given sampling period. A corollary to this is that the pressure head and volume of solution flowing at the source of the sample must remain constant.

The device will have to be modified for use in very dry climates where enrichment of the sample solution by evaporation might be a matter to consider. However, with an 8-hr. shift interval between collection of samples it is doubtful if evaporation would be sufficient to affect the results in the case of moderate-sized precipitation plants—say up to 1,500 tons daily. In any event the design of the sampler could be modified to minimize evaporation, and if necessary the entire arrangement could be locked to prevent tampering with the sample.

The sampler just described is an old expedient, and I am informed it was invented and used for the first time at the Tom Reed mill, in the Oatman district, Arizona. It simplifies the work of solution sampling and is easy to make and to install.

The Chiddey method of assaying solutions is widely used, but the procedure described in standard texts on assaying is not infallible for every type of solution. If precipitation results are consistently high or low in any plant it is well to check the assays by at least one other method for a period sufficient to give a reliable comparison between results. Generally speaking, the assay office is the least likely place to look for discrepancies concerning precipitation results, although the assay method was a source of trouble as described in the case of Plant B, on pages 45 and 46.

Accountability Calculations and Bullion Returns, Plant A

This plant was one of the simultaneous clarification-precipitation type manufactured by The Merrill Company. Two filter-bag tanks that contained 64 bags each were used for collecting precipitate and about 900 short tons of solution were treated daily. Clean-ups of precipitate were made every two weeks.

The arrangement of the plant made it easy to install a reliable sampling scheme. Clarified gold solution was pumped directly from the Crowe tower to the bag tanks and a small centrifugal pump that was fed by the zinc cone forced zinc dust into the system about 15 ft. ahead of the filter-bag headers. A ¾-in. line was tapped

into the clarified gold-solution line 20 ft. ahead of the zinc pump connection and solution from this source was led to a wire sampler as shown in Fig. 2. A barren solution sample was obtained in a similar manner by tapping the main line that carried this solution to the washing thickeners.

The setting of the valves on the sample pipes and the slopes of the wire cutters on the samplers were never altered except at the end of a shift sampling period, when, in the judgment of the operator, it was desirable to alter the volume of sample. At the end of each shift the solutions in the sample containers were well stirred and a fixed amount was measured out and transferred to a 2½-liter acid bottle. The reject of the sample was then discarded and a fresh sample was started at once. This practice maintained the proper proportion of sample solution from each shift, although the amount cut by the sampler might vary slightly from one shift to the next. The accuracy of the composite sample depended, among other things, on a constant rate of precipitation, and this was maintained at all times. The 24-hr. composite samples of gold and barren solution were used in the calculation of the amount of gold precipitated for the day. To keep a check on individual shift operation, a barren-solution sample was taken from each bag tank by the same method. The value of these samples, however, was not used in the accountability calculation, because it was not possible to operate both tanks at equal tonnages throughout a single clean-up period; moreover, the use of two samples would have increased the chances of error.

Each bag tank had a 12-in. rectangular contracted weir cut in the end partition. The edges of the weir notch were dressed to a knife edge with the sharp corners facing upstream. A stilling tank connection was welded into the bag compartment of each tank about 2 ft. upstream from the weir. These tanks were 9 in. in diameter and slightly higher than the bag tanks, so that they rested on the same floor. Hook gages were used for measuring solution level in the stilling tanks and the gages were made with adjustable pointers that could be moved when the weir was checked for a zero reading. A section of a carpenter's rule, graduated to sixteenths of an inch, was mounted rigidly on the stilling tank opposite the pointer of the hook gage.

Each weir was checked for a zero reading at every precipitate clean-up. While the bags were being removed from the tank the edges of the weir notch were scraped with a blunt-edged tool to remove lime deposits. After precipitation had been started with fresh bags the effluent was allowed to circulate back to the gold tank for half an hour in order to obtain a normal barren solution. At the end of this period the flow was stopped completely and when no more solution could be made to flow over the weir notch, the hook gage was set to the level in the stilling tank and the pointer was adjusted to read zero on the scale. It was not always necessary to adjust the pointer, but the routine outlined in the foregoing was carried out regularly to insure against accidental changes in the setting.

The bag tanks were always operated at a fixed rate of flow, so that it was mandatory to alter the setting of the feed valve and *not* that of the hook gage when the operator made the routine reading and inspection. This met the condition of constant solution tonnage upon which accurate samples depended and also avoided the uncertainties involved in trying to read and average weir heads of varying magnitudes. It is much easier for an operator to maintain a weir overflow at a specified point rather than to attempt to follow changes in level by estimating to the nearest scale marking. In this instance an error in reading of a sixteenth of an inch, the smallest scale division, would have amounted to 24 tons of solution per day per weir—a possible error of more than 5 percent.

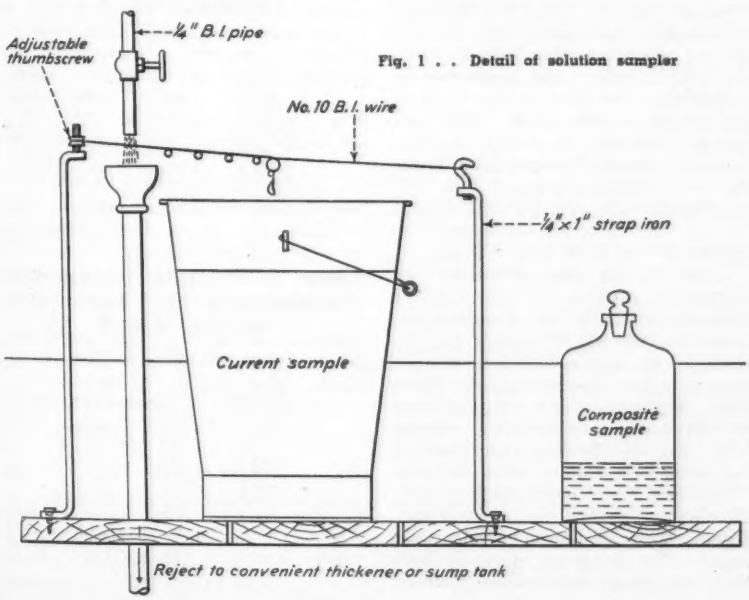

Fig. 1 . . Detail of solution sampler

The daily tonnage from each tank was estimated from a graph based on the Francis formula for rectangular contracted weirs. This was of the following form: $Q = 3.33\ (L - 0.2H)\ H^{1.5}$ in which Q = cu.ft. of water flowing per second, L = length of weir opening in feet, and H = head on weir in feet.

The standard Chiddey method[1] was used for determining the gold content of the solution samples. The ore was of ordinary cyaniding character and no metals were present in solution to interfere with assay procedure. Gold solution samples were assayed in triplicate portions of 10 A.T. each and the two assays that checked closest were averaged and reported as final. Usually all three assays checked each other. Barren solutions were assayed in duplicates of 10 A.T. each.

A comparison of calculated precipitation and actual bullion recovery for a period of seven consecutive months is given in Table I. The apparent overage of bullion is slightly less than shown by the totals, because the value of refinery slags and matte was not included in arriving at the balance. The total gold tied up in these products was very small. Calculated results given are based solely on solution tonnage estimates and assays and no attempt was made to eliminate discrepancies or to apply factors of correction. Although the practice in this plant resulted in a consistent calculated shortage, the results were considered satisfactory for the purpose of calculating daily mill heads and keeping a check on general mill performance.

Accountability Calculations and Bullion Returns, Plant B

The precipitation plant was a 20-bag Merrill Company with a daily capacity of about 80 gross tons. It had been installed in such a manner that it was impossible to obtain the necessary solution samples or to estimate tonnage for the purpose of calculating daily gold production. The changes that were made to attain these objectives properly may be of general interest.

Clarification was accomplished by sand filters which discharged to two interconnected gold-solution storage tanks. There was not sufficient head-

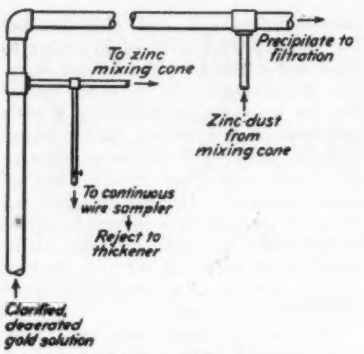

Fig. 2 . . . The clarified gold solution line was tapped as shown

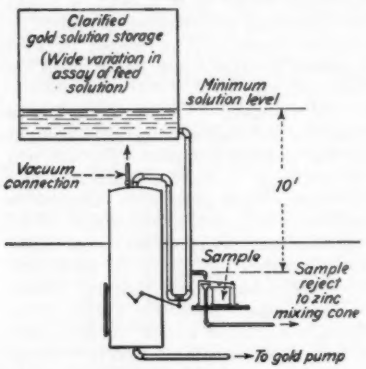

Fig. 3 . . . Sketch showing sample being taken from discharge line from gold tank

room to combine the discharge of the clarifiers for sampling purposes, and the problem of obtaining a representative sample of this solution was further complicated by the fact that the value varied between 0.10 and 15.0 dwt. per ton over a period of an hour. The reason for this was that the sole source of solution was the effluent from a Moore filter the complete cycle of which required about an hour.

As shown in Fig. 3, the discharge line from the gold tanks was connected directly to the Crowe tower, which was equipped with the conventional butterfly valve for maintaining the proper solution level inside the tower. When the solution storage tanks were full there was a pressure head of about 14 ft. on the butterfly valve; accordingly, a sample pipe was tapped into the line just ahead of the valve. The sample so obtained was representative.

The solution to this sampling problem was unorthodox and cannot be recommended as safe practice. A more satisfactory method from an operating standpoint would have been to have installed a steady-head tank for feeding the Crowe tower, but this was physically impossible.

A barren-solution sample was taken by means of a wire sampler from the discharge line of the pump which was connected to the discharge compartment of the bag tank. The same detail of cutting samples and of sample collection was followed as described for Plant A in the foregoing.

A part of the barren pump discharge was originally bypassed to a steady-head tank, which was in turn connected to the zinc cone. Inasmuch as solution tonnage was regulated by measuring the weir head in the bag tank, the tonnage estimate was in error by the amount of solution bypassed for mixing zinc dust. The amount so bypassed varied considerably and it was necessary to discontinue the use of barren solution in the zinc mixing cone. A substitute was obtained by bypassing a part of the gold pump discharge back to the cone. The flow was regulated by a float-and-valve arrangement that operated in a special steady-head tank attached to the cone. The gold pump was connected to both the zinc cone and the Crowe vacuum tower; therefore the bypass solution was laden with precipitate and zinc dust. It is of interest to note that the regulating valve did not foul with this material or give trouble in any way, which is contrary to what would reasonably be expected. Both the steady-head tank and cone were locked to prevent theft of precipitate.

A stilling tank and hook gage, similar to the installation described in the foregoing, was used for measuring the weir overflow. As in the previous instance, also, the practice was to maintain a constant precipitation tonnage. No attempt was made to estimate tonnage by formula, because the weir knife edges had been damaged during plant erection and the formula would not have applied. Tonnage estimate was made by direct volume measurement as described in a succeeding paragraph.

At the start of each run with fresh bags the weir notch was cleaned and the gage was checked for zero setting. Precipitation was then started, and at the first convenient time, usually the day after the precipitate clean-up, the weir overflow was measured by determining the gain in the level of the barren solution tank. This tank was of sufficient size to give a measurement period of about four hours, and the tonnage calculated from this calibration was used for the ensuing life of the precipitate bags. The method proved to be quite reliable.

Assay of the plant solutions constituted a problem in this instance because the content of dissolved material was around 40 lb. per ton, including an appreciable amount of copper. The discrepancy of results from duplicate assays was sufficient to affect the accountability calculation, and considerable experimenting was done with various assay methods. It was first found necessary to modify the Chiddey method until it gave consistent checks on duplicate determinations. The following methods were then tried using the modified Chiddey procedure as a standard: reduced copper sulphate[3], an electrolytic procedure[3], and evaporation with litharge. All three methods gave consistently lower results than the selected standard and each was abandoned in turn. The modification of the Chiddey method was carried out as described in a following paragraph.[4]

To a 10 A.T. portion of solution was added 25 grams of commercial lead acetate and the mixture was brought nearly to the boiling point. From 2 to 3 grams of Merillite (zinc dust) were then stirred into the mixture, which was then allowed to stand for 15 min. near the boiling point. After taking from the hot plate the excess zinc was removed from the sponge with commercial hydrochloric acid in the usual manner. The sponge was then filtered, partly dried, and fused in a new crucible with the following flux: soda ash, 60 grams; borax powder, 25 grams; and litharge, 35 grams. The resulting lead button was cupelled and the assay completed in the customary way.

The standard Chiddey method gave trouble, due to the formation of a granular sponge that was difficult to collect and that could not be cupelled directly on account of the large amount of base metals that were precipitated with the lead and gold. The flux used in the modified method was slightly oxidizing and was effective in producing a normal lead button.

Results of nine months' operation with the routine described are shown in Table II. The discrepancies in gold recovery from month to month are due to the method of refining and the precipitate which involved the carry-over of appreciable amounts of

Table I—Monthly Precipitation Accountability and Bullion Production, Plant A

Fine Gold, Troy Ounces

	Gold Calculated	Bullion	Plus	Minus
	1,466.8	1,483.4	16.6	....
	1,292.9	1,298.4	5.5	....
	1,498.9	1,479.1	....	19.8
	1,322.3	1,349.8	27.5	....
	1,336.9	1,381.9	45.0	....
	1,372.2	1,384.9	12.7	....
	1,382.8	1,406.0	23.2	....
Totals	9,672.8	9,783.5	130.5	19.8
Net			110.7, or 1.1 percent	

Table II—Monthly Precipitation Accountability and Bullion Production, Plant B

Fine Gold, Troy Ounces

	Gold Calculated	Bullion	Plus	Minus
	378.7	338.0	....	40.7
	426.8	526.3	99.5	....
	379.0	392.4	13.4	....
	362.0	372.7	10.7	....
	338.3	326.5	....	11.8
	338.2	356.7	18.5	....
	315.5	336.8	21.3	....
	299.2	246.2	....	53.0
	404.1	428.6	24.5	....
Totals	3,241.8	3,324.2	187.9	105.5
Net			82.4, or 2.5 percent	

gold from each refining operation. The period covered by the tabulation was also one of experimentation with bullion refining methods and the discrepancies in gold recovery were greater than would have been the case had a standard refining procedure been used throughout. It was not expedient to determine the amount of gold contained in intermediate products at the end of each month, but the balance at the end of the period shows the accuracy of the accounting method.

The results given in the two examples outlined show that accurate accounting of precipitation results is possible and the methods described are applicable to most plants that employ zinc-dust precipitation. Some plants might not be amenable, due to the arrangement of equipment. It might be argued that the care and attention required to check precipitation within a few percent of bullion production is not justified. Certainly no amount of care would be successful in detecting theft of precipitate except in large amounts that would be detected in other ways. However, it is a source of considerable satisfaction to an operator to know what the plant is doing in the way of production at all times. The information can also be used to calculate ore heads within reasonable limits.

Of the factors that affected the accuracy of the accountability calculations in the two examples cited, the following were common to both plants:

1. Sampling points were selected to yield representative solution samples and a simple, accurate sampling routine was devised for the operators.

2. The weirs were of similar design and both were characterized by a low velocity of approach to the weir. This makes for accuracy in measuring the head.

3. A constant precipitation tonnage was maintained so far as was possible in both plants. This has a decided effect on sampling and tonnage estimation.

4. Weirs and hook gages were checked for accuracy at short intervals.

5. Sampling and precipitation of gold solution was simultaneous in both instances; that is to say, clarified solution storage did not intervene between the automatic sampler and the precipitation equipment. If solution is stored in any quantity in this manner there exists a "lag" in sampling that is likely to result in appreciable errors, especially if the value of the solution is subject to rapid changes as in the case of Plant B.

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[2] Clennell, J. E.; The Cyanide Handbook, 1st Ed., p. 443.

[3] Crichton, C.: *Journal Chem. Met. & Min. Soc. South Africa*, Vol. 12, p. 90.

[4] Devised by C. B. Nines.

The Sinking Cycle at No. 2 Shaft of the Union Potash Mine

IN THE COURSE of sinking the No. 2 shaft at the mine of the Union Potash & Chemical Co., in the Carlsbad district, New Mexico, no effort to attain speed was made, as told in the April issue of *E.&M.J.* A bonus was nevertheless paid the men during the sinking of the shaft, which has two 5x7-ft. hoisting compartments and an 8x7-ft. manway and was sunk to 899 ft. before it was stopped in January, 1941. Sinking was conducted on each of the three shifts with a nine-man crew consisting of one shift boss, five miners, two top landers, and a hoistman. The shaft entered the salt at 407 ft. below the collar and continued in it thereafter to its present bottom. The cycle of sinking operations both above the salt and in the salt was as follows, according to M. J. Sheridan, safety engineer on the company's staff at Carlsbad:

Cycle of Operations in Sinking No. 2 Shaft

Above the Salt

Typical shaft cycle above salt in gypsum rock, concreted section. Depth of shaft 107 ft. at beginning of cycle. Depth of bottom of last concrete pour 96 ft. Cycle started with full muck pile. The 8-hr. shifts are separated from each other by horizontal lines.

Mucking	8 hours
Drilling, loading, blasting, smoke delay	3 hours
Mucking	5 hours
Mucking	3 hours
Drilling, loading, blasting, smoke delay	3 hours
Mucking	2 hours
Mucking	6 hours
Drilling, loading and blasting	2 hours
Mucking	8 hours
Drilling, blasting, loading, delay	2½ hours
Mucking	5½ hours
Mucking	4 hours
Drilling, loading, blasting, delay	3 hours
Installing water line	1 hour

FULL MUCK PILE AT THIS POINT, DEPTH OF SHAFT 138 FT.

Hanging forms, (four 5-ft. sets to be installed)	8 hours
Installing forms and reinforcement	8 hours
Pouring concrete and installing steel dividers	5 hours
Installing forms	3 hours
Pouring concrete and installing steel dividers	4½ hours
Installing forms	3½ hours
Pouring concrete and installing steel dividers	6 hours
Installing guides, ladders, etc.	2 hours

Bottom of concrete now 116 ft.

BACK TO MUCK PILE

Below Concreted Section
Sinking in the Salt

Depth of shaft 654 ft. Depth of last set of steel dividers 616 ft. Cycle started with full muck pile.

Completion of previous steel work	4 hours
Back to muck pile. Mucking and cutting hitches for future steel dividers from muck pile	4 hours
Mucking	4 hours
Drilling, loading, blasting	4 hours
Mucking and cutting hitches for future dividers	8 hours
Drilling, loading, blasting, smoke delay	3 hours
Mucking and cutting hitches	5 hours

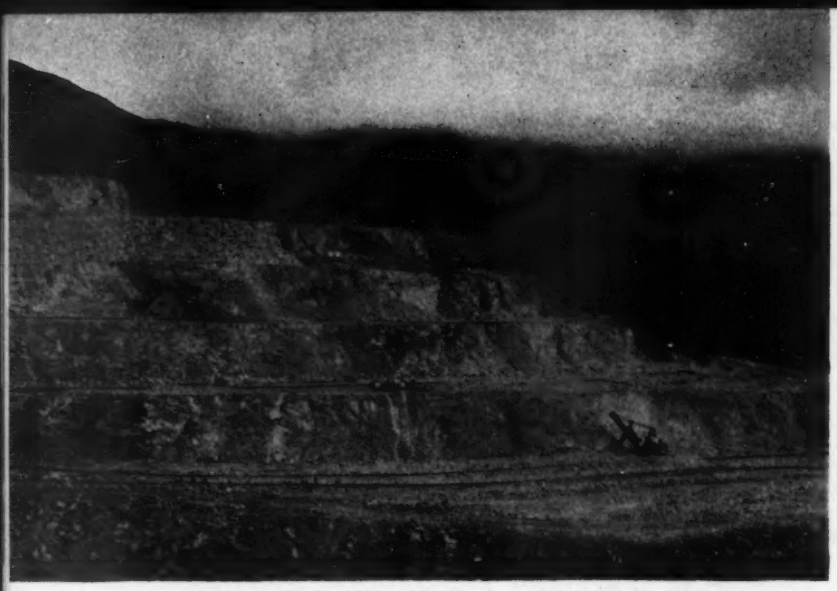
DEPTH OF SHAFT 663 FT. AT THIS POINT. PORTION OF LAST MUCK PILE STILL IN BOTTOM

Four sets of steel dividers to be installed at 5-ft. intervals Installing steel dividers in hitches with concrete grout	8 hours
Installing dividers	6 hours
Installing guides	2 hours
Installing ladders and landings	2 hours

BACK TO MUCK PILE

Mucking	3 hours
Drilling, loading, blasting	3 hours

Etc.



4½-yd. shovels at work on some of the lower benches near the ore zone

Morenci Enterprise Nearing Production Stage

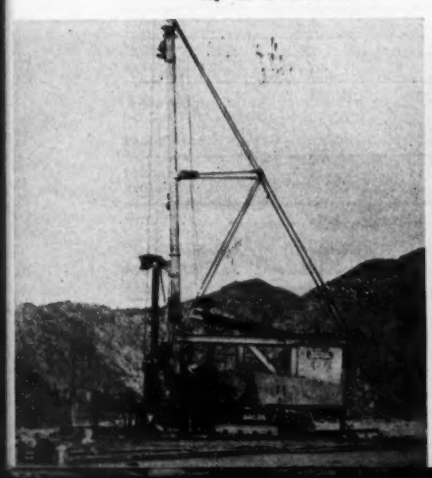
John B. Huttl
Assistant Editor

DEVELOPMENT of the large open pit and construction of surface and reduction plants—a $35,000,000 project inaugurated by Phelps Dodge Corporation at Morenci, Ariz., more than three years ago—are proceeding at a rate that assures active production early in 1942. During 1940 some 12,500,000 tons of waste and 600,000 tons of ore were removed from the pit, and the total tonnage mined since commencement of operations exceeds 30,000,000 out of an estimated 43,000,000 tons of preliminary stripping required for a desired daily production of 25,000 tons. The porphyry orebody, with a height of 850 ft., contains about 230,000,000 tons of 1.06 percent copper ore, and the average thickness of the overburden covering it is 220 ft. As the ore-waste ratio is approximately 1:1, more than 230,000,000 tons of waste rock will be removed during exploitation of the ore zone proper.

Since my last visit to the property, early in March last year, many improvements have been made at the pit and new equipment has been added. The new car and locomotive repair shop completed in 1940 near the entrance of the pit is a model, fireproof structure containing the latest in metal-working machinery and welding equipment. Running time of machinery active in the pit has been kept at a maximum by repair trucks with welding apparatus on trailers. Haulage grades have been improved in many parts of the pit, bringing about greater efficiency of the haulage trucks and fewer repairs, and completion of numerous waste fills has made possible straightening of curves on the main rail lines and consequent stepping up of train speeds. New benches and switchbacks have been established, and by early May additional benches, including the 4,750 level, are expected to be equipped for rail haulage. Ore production for test-mill purposes has been increased to nearly 3,000 tons per day, which is handled at the old concentrator situated a short distance from No. 6 shaft. A major part of the ore is mined from two benches below the 5,000 level and hauled in 30-ton side-dump cars to the upper floor of the test pit, where it is stockpiled. Here it is loaded by 1½-cu.yd. diesel shovels into 5-cu.yd. trucks and hauled to the concentrator.

Development of the uppermost parts of the pit is carried forward by earth-moving units, each consisting of a 4½-cu.yd. full-revolving electric shovel, 22½-cu.yd. trucks, and a large bulldozer to keep the roadway clear, while 4½-cu.yd. full-revolving shovels and 30- and 40-ton side-dump cars drawn by 1,000-hp. diesel-electric locomotives are used on the remaining benches established in the pit. The shovels receive electric current at 2,300 v. from individual switchboxes connected to the main power lines carrying 13,000 v., and most of the large haulage trucks have been fitted with 150-hp. diesel engines. Current truck haulage-rail haulage ratio is about 1:1. Work is under way to electrify the switchbacks and main ore haulage tracks to

An electric churn drill at work on top of a 50-ft. bench



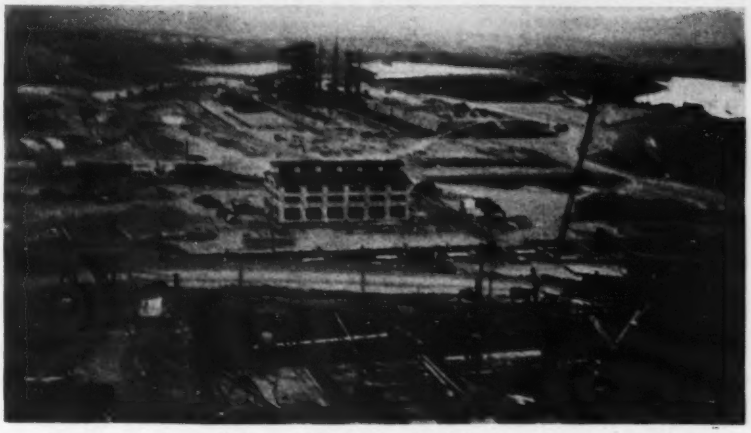
General view of Morenci pit. Note slag ballast on main haulage tracks and posts for overhead trolley wires

the primary crushing plant 2½ miles distant from the entrance of the pit. A combination trolley-storage battery locomotive will be used on these tracks, which can be operated without bonding and overhead trolley construction when desired. The unit also will use dynamic braking, thus assuring a minimum of brakeshoe wear and general brake maintenance. Between the 5,200 and 5,000 levels diesel-electric haulage will be practiced. As to car equipment, it has been definitely decided to use 40-ton side-dump cars both for ore and waste transportation.

No major changes were made in drilling and blasting operations during 1940. Primary drilling is done by electric churn drills using 9-in. bits, and pneumatic drills and special toe-hole drills are used in block-holing and toe-holing operations. Steel drills used in secondary drilling are fitted with detachable bits. The benches are 50 ft. high, and the churn drill holes are spaced 15 ft. from the crest of the bench and 15 ft. apart. The shovels clean up the benches to hard face, and in many instances toe-holing follows to obtain a vertical bank for blasting. Powder charges vary according to the character and hardness of the ground. Use is made of powder varying in strength from 40 to 60 percent, usually primed with a 12½-lb. cartridge of gelatine, (40 percent). Detonation is effected by Primacord. More than 50,000 tons of ore and waste rock are removed a day (all operations on a three-shift basis), with floodlights providing adequate illumination for night work.

Equipment currently employed at the pit includes seven 4½-yd. full-revolving electric shovels; six 1,000-hp. diesel-electric locomotives; one 600-hp. diesel-electric locomotive for switching service; one 10-ton diesel locomotive; eighteen 22½-cu.yd. trucks; fourteen electric churn drills; two dump plows; one 150-ton steam crane; one 50-ton diesel-electric crane; three mechanical track shifters; 30- and 40-ton side-dump cars; 1½-yd. diesel shovel and 5-cu.yd. trucks for hauling ore to the old concentrator; and special units such as wagon drills, fuel-supply trucks, grease trucks, repair trucks, sprinkler trucks, etc.

View of completed machine shops at reduction works site

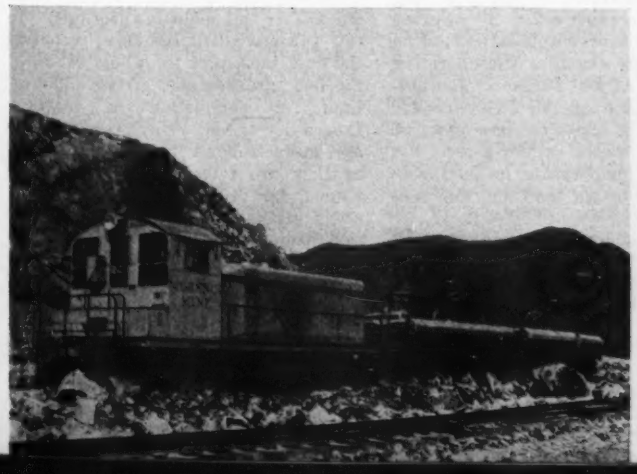


View of reduction works site. Concentrator foundations in foreground. Steel for smelter going up in back

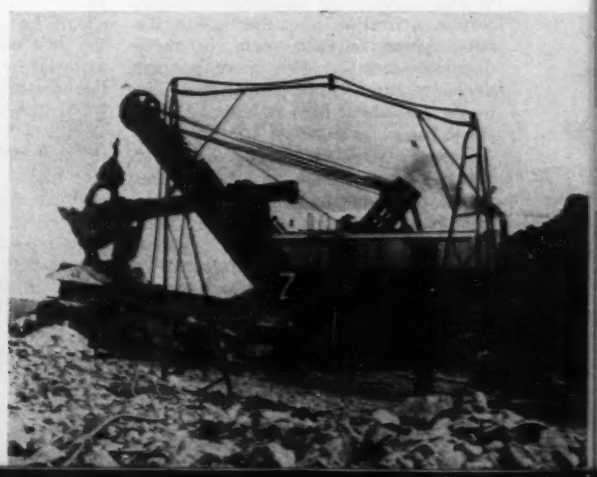
Test work conducted for more than a year at the old concentrator near No. 6 shaft to determine the flowsheet for the new 25,000-ton concentrator in course of construction has been completed. The plant is now treating some 3,000 tons of pit ore a day. The flowsheet of the new concentrator will be as follows: Primary crushing in a 60-in. gyratory crusher; subsequent reduction in standard and short-head cone crushers, with mechanical screens in open circuit between them; single-stage grinding in 10x10-ft. ball mills with duplex submerged spiral classifiers; rougher and cleaner flotation in mechanical flotation machines; regrinding concentrates in 8½x12-ft. ball mills with spiral type classifiers; thickening of concentrates in 100-ft. thickeners; concentrate filtering in disk-type filters; and dewatering tailings in a series of 300-ft. thickness.

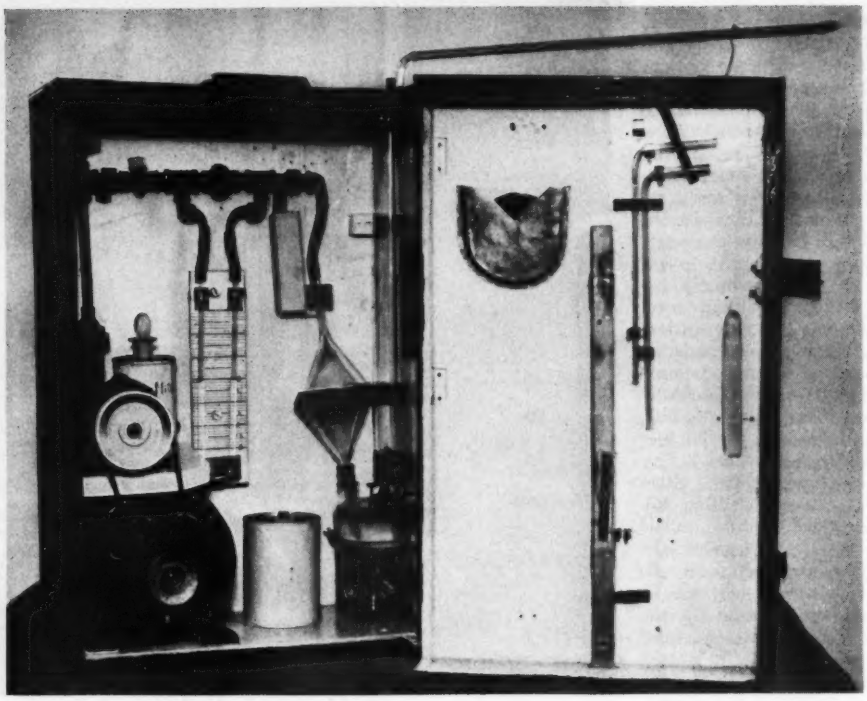
The site of the reduction works is about 2½ miles south of the pit. Here, construction of the primary and secondary crushing plants; concentrator; machine shops; car repair shops; warehouse; change house; crushing and bedding plants for the smelter; laboratory and assay office; a modern steam power plant; smelter; and dewatering plant is proceeding according to schedule. The machine shops, warehouses, change house, and timekeeper's office already completed are all fireproof structures containing the most modern equipment available. New units have been added to the model town of Stargo, and a new settlement is under construction near the reduction works site.

A 4½-yd. electric shovel loading into 40-ton side-dump cars drawn by 1,000-ton diesel-electric locomotive



A 4½-yd. full-revolving electric shovel and 22-yd. trucks





Portable apparatus to determine condenser losses of mercury

Mercury Losses in Furnacing Ores

Improved portable apparatus simplifies their determination in condenser gases

Harry J. Morgan
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THE PRESENT WAR has increased the price, and as a consequence has stimulated the production, of mercury. To increase production of mercury in the United States materially, it has been necessary to treat ores of lower grade. The increase in the price of mercury has made a high recovery much more important, and the losses, especially those due to incomplete condensation, are greater when treating lower-grade ores. Most of the mercury recovered in the United States today is either from the rotary or the Herreshoff type furnace. Each of these furnaces has certain operating advantages, but the main losses in each occur in three divisions—namely (1) mercury not driven off, and lost in the calcines; (2) losses in discarded dust; and (3) stack losses.

Losses in the calcines can be easily determined by assay, and can be reduced by changing temperature and time of furnacing or possibly by finer crushing of the feed. These losses, which can be easily determined by panning, can be kept under control. The extent of loss due to various factors can be estimated by panning the interior of the larger lumps to see whether the cinnabar has been decomposed. Losses in the discarded dust can be determined by assay, and if the dust is panned and is found to be of value, re-treatment of the dust is necessary until such time as values are negligible. If the values are in the form of finely condensed mercury globules mixed with dust, the dust collector temperature is too low and should be increased either by covering the dust collector with heat-insulating material or by changing the operating temperature of the furnace. The outlet temperature of the dust collector should be kept above the dew point of the mercury vapor in the gasses, but any higher temperature means waste of fuel and extra load on the condensers.

It is possible that some mercury vapor will be cooled below the dew point in the dead space not kept heated by inflow of hot gasses, and when this condition exists, it can be remedied by heat insulation so that every part of the dust collector is sufficiently hot. If mercury is found in the dust in the form of particles of undecomposed cinnabar, this is due to finely divided high-grade cinnabar dust that has been caught up in the dust stream and carried out of the furnace before it has been heated to the requisite temperature for the necessary time to oxidize the cinnabar and release the mercury. If this loss is excessive, a furnace in which firing is concurrent with the feed is indicated (such as used at the Sulphur Bank quicksilver mine in California). In this furnace all of the feed, including the dust, must pass the whole length of the hot furnace tube, giving sufficient time for completion of reaction. Losses due to incomplete condensation are more difficult to determine, and as they are invisible they are often blamed for failures brought about by other causes. Most of the condensation towers and others in modern quicksilver treatment plants are much more compact than those of older plants. The condenser system has been

blamed for losses when the real cause for low production has been ore of too low a grade. Additions to the condenser system have often been made whenever new technical management took over, even if already larger than necessary. The losses in the condenser systems are:

1. Soluble mercury lost in water from sprays and condensate (generally small).
2. Float mercury and mud in water sprays and condensate (can be minimized by proper settling).
3. Mercury lost by riding out on smoke and ore-dust particles (minimum draft will lessen difficulties of collection).
4. Mercury lost as minute globules or fume (too rapid chilling by sprays said to form more minute fume particles).
5. Loss due to vapor pressure of mercury corresponding to outlet temperature.

(This loss is small at reasonable stack temperature, and because it varies directly with the gas volume it can be reduced by keeping at a minimum the excess air for combustion, and also air leaks. The amount of air excess can be determined by analysis by an Orsat flue gas analyzer. Naturally, the lower the stack temperature, the smaller the loss, but even up to 40 deg. C. the loss is not large. The fire should be adjusted so there is no visible smoke and dust, and the fume can be recovered by using condensers and towers in which the direction of gas flow is changed many times. The towers should be designed to give maximum impingement of dust particles against the walls. Baffle towers in which the gas velocity has been reduced will also stop dust and fume. Sprays are successfully used. There should be no dust issuing from the stack, and if the dust is stopped the fume also will be saved.)

6. Mechanical and handling losses can be reduced by use of concrete floors and careful handling of mercurial products. Control of leaks of plant equipment is easier with the more compact modern plants.

Determination of Condenser Losses

In a bulletin published by the U. S. Bureau of Mines in 1918 an apparatus for the determination of losses in condenser gases was described by C. N. Schuette.[1] This unit is somewhat bulky, and consists of a train of glass apparatus as follows: Sampling tube, condenser, glass bead tower, filter, gas meter, regulator, and vacuum aspirator. There has been a need for a portable apparatus to determine condenser losses, and the device to be described is practically the same as that used by Schuette except that it is much simpler and housed in a portable case less than 2 cu.ft. in size. The carrying case is 12 in. wide, 24 in. high, and 18 in. long. There is also room to carry a small Orsat.

General layout of the equipment is shown in the accompanying photograph. The glass sampling tube, which is 18 in. long and ¼ in. in diameter, is closed at one end and has an opening at one side near the end made by blowing the heated glass. The tube is placed in the gas stream so that the opening is facing the gas flow, and should be of such size that the inlet velocity is about the same as the velocity of the gas stream. The condenser tube is 16 in. long and made from ¼-in. glass tubing, and the gases after passing through it move upward through glass beads which remove the entrained condensed moisture. A bottle with two necks holds the glass beads.

Next, the gases pass upward through the lower glass funnel to the filter paper. Above this qualitative filter paper is placed another funnel connected to the orifice meter. The filter paper is placed between the two funnels (3 in. in diameter) and reinforced by a screen disk set above the paper to give the support needed when the paper is weakened by dampness. The two funnels are fastened together, face to face, by a wide rubber band, or preferably by a 2-in. section of an inner tube from a bicycle tire, which holds the ground-glass faces of the funnels together and gives a tight seal. The orifice meter consists of a standard pipe union with an inserted piece of capillary glass tubing placed in a small rubber stopper. Standard ⅛-in. pipe tees on each side of the orifice are connected to a glass U-tube, from which the differential pressure can be read.

The orifice meter is easily calibrated by measuring the air discharge at various differential pressures through displacement of water from an inverted bottle. For portability, the caustic soda solution used for washing gases[1] has been replaced by a soda-lime container. This soda lime is to protect the vacuum from acid gases, and no correction is needed for change in volume, as the gases are measured before removing carbon and sulphur dioxides. Most of the glass tubing has been replaced by a ⅛-in. pipe, and a motor-driven vacuum pump has taken the place of the aspirator. The six-volt motor is powered by an ordinary storage battery, and though oversize it will operate a number of hours without the necessity of recharging the battery, as the current drain is only 15 to 20 amp. Use of the battery makes the apparatus self-contained.

Procedure of making a test is as follows: The box containing the apparatus is placed near a hole bored in the stack. The condenser jacket is filled with ice water, which is replenished during the run if the water becomes warm. Ordinary water can be used if ice water is not available, but use of latter permits a longer run without the filter paper becoming damp. The sampling tube is carefully inserted in the gas stream, with the opening facing against the gas flow. Use of a paper wrapping around the tube is advised[1] to prevent salting of the sample by condensed mercurial products from the sides of the stack. The motor is started, and the flow kept constant for a half hour or more. The flow will gradually decrease if the filter paper becomes damp, but by adjusting the regulating valve the flow can be kept constant for some time.

At the end of the run the sampling tube is carefully removed, the outside cleaned, and the inside washed out with concentrated nitric acid. The condenser tube, glass beads, and the funnel below the filter are thoroughly washed in the same manner, and the washings, together with the filter paper, are placed in a sample bottle. The apparatus then is reassembled, and is ready for another test. Accumulations of dust may be found wherever there is a change in direction of the gas flow, especially at the 90-deg. elbow just above the condenser. Appearance of this dust will possibly give a clue as to the reason for the losses of mercury that are found. The solution of mercury in the sample bottle is evaporated with sulphuric acid, and the nitric acid fumed off. This fuming will prevent formation of free sulphur when hydrogen sulphide is passed into the solution, the next step. The mercury is precipitated as sulphide, and can be filtered on a Gooch crucible, dried, and the asbestos sulphide mixture treated as an ore. The mercury can be determined by the Whitton method, or volumetrically. Results can be calculated so as to give milligrams of mercury per cubic foot of gas.

The amount of flue gas can be determined by using a Pitot tube, providing the velocity in the stack is sufficient to give a reasonable differential reading. The results can be checked by finding the amount of carbon dioxide and the excess air in the flue gas. Since the amount of fuel burned is known, the volume of gas passing out the stack can be calculated. Use of the Orsat for analysis of the gas will also show where there is excessive dilution, due to air leaks. There are some variations of results even on check runs. Some of the calculations cannot be made absolutely correct, but the limits of error are less than those due to irregularities of plant operation.

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[1] "Fume and Other Losses in Condensing Quicksilver From Furnace Gases." U. S. Bureau of Mines, Technical Paper No. 96 (1918) by Duschak and Schuette.

SALTING

The nefarious "art" and its age-old results as practiced on the mining fraternity. (Second part of a series)

T. A. Rickard

WALTER McDERMOTT has recorded his experience in another salting fiasco.[5] In the early eighteen-seventies there came, to Toronto and Detroit, rumors of a valuable tin discovery on the northern shore of Lake Superior. Late in the autumn some American speculators brought a Cornish mining captain to examine the tin prospect. A glowing report was issued and a company was formed by capitalists of Detroit and London; rich samples were on exhibition, and some of the metal from them was smelted for the purpose of presenting the shareholders with tin spoons. It was too late in the season to do any mining, for in winter this part of Ontario was almost inaccessible. So time was given for the excitement to grow. Meanwhile the news of the discovery had reached McDermott, who was at the Silver Islet mine, and he was deputed from London to make an investigation of the tin vein. To do this he had to travel 150 miles on snowshoes. His party arrived in due course and examined the alleged discovery. Much ingenuity had been expended in making a tin vein, a truly artificial ore deposit; some natural cracks in the rock had been filled with a mixture of broken tin ore from Cornwall, tailing from a copper-concentrating mill in Michigan, and a soluble silicate for cementing material. In the former camp of the promoters McDermott found a barrel containing the soluble silicate that was used to create a tin vein. He removed most of the synthetic ore. In later years he met the perpetrator of the hoax in Colorado and was introduced as the man that had "taken away his tin lode in a small boat." The favorable report of the experienced Cornishman was explained later by the fact that "he was not accustomed to the particular vintage of champagne used on the expedition."

Even the most circumspect of engineers may become the victim of salting, as we have seen. Most of us mining engineers, at some time or other, have been deceived; and usually it is only by good luck that we have detected the fraud in time—that is, before much money has changed hands. In Arizona, many years ago, one used to hear the story of how Professor James Douglas was salted. While engaged in the highly successful development of the Copper Queen mine, at Bisbee, his attention was drawn by his colleague Benjamin Williams to some copper claims near the Gila River that seemed promising. They belonged to a man named Tweed, a freighter; that is, he earned his living by carrying ore in wagons pulled by mules. Williams had sampled the ore and had pronounced it to be of good grade. Unfortunately his samples had been salted. It was his habit to put the samples into small twill sacks and store them in a large carpet bag. At that time the leather bottom of the bag happened to be in disrepair and it had been sewed with twine made from common sacking. While Williams was asleep, Tweed cut the twine, opened the bag, and then judiciously enriched the samples by adding a proper proportion of powdered malachite, or copper carbonate. The samples were then replaced and the hole in the bag was repaired. Douglas knew that Williams was a careful man, and therefore accepted his results without question. When he himself therefore went to sample the ore, he was not as careful as usual, so that his samples, also in a carpet bag, were salted skilfully, the resulting assays being in harmony with those obtained from Williams' previous sampling. Thereupon Douglas bought the claims on account of Phelps, Dodge & Co. and erected a small smelter, the operation of which promptly proved the fraud. Nevertheless he did not discard the mine, he continued to do the assessment work continuously every year for 20 years, and finally sold the claims on their merit, by aid of a higher price for copper, to another company for a sum nearly large enough to recoup his clients for their original outlay.

Another mining engineer of wide experience, Edward T. McCarthy, records an interesting case of salting in his memoirs.[6] This account he has supplemented in recent correspondence with me. The mine was an alluvial tin deposit in the State of Johore, on the Malay Peninsula, that had been worked by the Chinese and was sold to an English company in London. Mr. McCarthy was deputed to make an examination. The workings consisted of an oblong pit, like a quarry, excavated to a depth of 15 to 20 ft. At a depth of 15 to 17 ft. extended the "karang," a layer of sediment in which the tin had been concentrated by fluviatile agency. It was, in miner's parlance a deep lead of tin.

The Chinese stripped this layer by removing the overburden of barren gravel. They did this by aid of a short and broad hoe, which scraped the gravel into wicker baskets. Two of these, picked up by a hook at each end of a bamboo pole extended across the shoulders, made the load for a coolie. He slipped the hooks quickly into the rattan loops affixed to each basket and carried them at a jog trot up a bamboo-built gangway to the dump, where the contents were emptied. A continuous stream of coolies came and went in circular procession until all the overburden had been removed, exposing the rich karang underneath. This was removed in a similar manner and deposited at the head of a series of sluice boxes into which it was fed with shovels. The running water washed away the lighter sediment and left the tin ore, cassiterite, ready for the final washing in wooden basins, buddles, or sloping tables. When clean, the tin concentrate was dried, bagged, and sent to the smelter.

[5] *Ibid.*, p. 121.

[6] E. T. McCarthy: "Incidents in the Life of a Mining Engineer," p. 283; 1918.

Such were the conditions when our engineer arrived from England. The yield of the mine had not justified the purchase and the British owners wanted to know what was the matter. The vendor, an English mining engineer, claimed that the company's Cornish miners did not know the technique of the necessary operations. What impudence! On his arrival Mr. McCarthy at once proceeded to sample the exposed faces of the karang, and satisfied himself that it was too poor to be exploited profitably. Next he took large samples until he had about 50 tons ready for washing on the buddles. To his surprise the stuff proved rich. Obviously he was the victim of salting; but who had done it, and how? He repeated the accumulation of large heaps of the karang and the subsequent washing, with highly satisfactory results. He was, nevertheless, certain that the enrichment was the result of trickery, because he sampled the baskets on their way from the workings and ascertained that they were poor in tin. The supply of tin (that is, cassiterite) for salting could not last for ever, so he continued until shortly no more was forthcoming. A further exhaustive sampling of all the exposed ground confirmed his opinion; thereupon he stopped the operations, and withdrew the English workmen and the Chinese coolies, being prompted to do so without needless loss of time because malaria was rife in the locality. Many Chinese had died there in the previous three months and all the members of the English staff were invalided.

Mr. McCarthy was unable to discover how the salting was done. He used to inscribe his initials on the soft mass of alluvial dirt and found the marking apparently untouched the next morning, nor had the heap suffered any change of shape. Several years later, it was learned from the Chinese that the perpetrator of the trick was the vendor himself. He had with him some twenty coolies, who were camped about a mile away in the jungle. At night they had skilfully salted the successive heaps of gravel, taking care to copy Mr. McCarthy's initials, which, as I have said, he had traced on the heaps for the very purpose of circumventing chicanery.

Women are known to have participated in salting schemes. A shallow placer in the province of Nueva Ecija, in the Philippine Islands, was the scene of such an affair recently. The gravel was 12 to 15 ft. thick and the gold particles were from fine to medium in size. The yield, as determined by preliminary drilling, was from 20 to 25c. per cubic yard. Four-inch Empire drills were used and a number of pits were dug to check the drill returns. The material pumped from the bores or dug from the pits was panned by native women, who were expert at their work and were under constant supervision, to assure reliability of the results. The women wore a Mother Hubbard kind of dress, with a pocket over the left breast, and normally while they were engaged in panning they sat in the water, which came almost to the waist. Preliminary results were remarkably uniform and indicated that the alluvial mine was decidedly promising. Nevertheless, suspicion was aroused, perhaps because the panning gave yields too uniform, from the point of view of wide experience in such matters. Clever detective work disclosed the fact that the women were supplied daily with a small amount of gold that had been panned from gravel in this same locality. The gold was carried in the upper-left pocket and transferred in small and appropriate doses to the pan by means of a wet finger. This "salting" was clever in that the gold used came from the same district and therefore would escape detection, not being incongruous, under the microscope. Moreover, the method ensured an addition that was fairly uniform, and therefore unlikely to arouse suspicion.

Nearly 50 years ago, in 1890, the Mulatos mine, in the Mexican State of Sonora, earned an undesirable notoriety on account of successful salting. It was owned by two brothers, Manuel and Leocardio Aguayo, of Guymas. They had bought the mine, then already 60 years old, in 1869. Their manager was Luis Canizeros, a skilful and unscrupulous fellow. In 1888 the mine had seen its best days. A Canadian, James Lord, was making a little money by blasting the old workings and treating the mass as low-grade ore instead of trying to pick out the rich streaks, as had been done formerly. He was extracting about $3 of gold per ton.

Don Manuel sold the mine to a Californian group, headed by Alvinza Hayward, and received a cash payment of $75,000. The examining engineer, Daniel B. Gillette, had sampled the mine carefully and reported an abundance of ore carrying from 7 to 9 pennyweights (or $7 to $9) per ton. He remained as manager for the new owners, and started the mine and mill to work. When, after a few days, the yield was found to average about $3 per ton, Gillette had a confidential chat with Lord, and discovered that he had been the victim of salting. Lord helped Gillette to ascertain how it was done.

The samples had been stored in a little wooden building having only one room. The bags were sealed and the door was closed by a Yale lock. Nobody apparently could tamper with the samples. However, someone did. The building had one window, 7 ft. above the floor, and about 18 by 24 in., with no sash. Two men perpetrated the trick at the instigation of the manager of the mine, Canizeros, acting for Don Manuel; one of them, a little fellow, climbed through the window, and did as he was instructed. His companion carried a bottle of dilute gold chloride, which the little man injected "artificially," as they said in Elizabethan days, meaning artfully or skilfully, by aid of a small syringe into the samples within the bags. Apparently the amount of the additament, to use another old word, was nicely calculated, so that the samples were not made suspiciously rich; the content was increased to about 8 pennyweights per ton, which represented moderately profitable ore. When the evidence had been gathered, a suit was threatened by the Californians against Don Manuel, but he acknowledged the malpractice and tendered $25,000, explaining that $30,000 had gone to Porfirio Diaz, the President of Mexico, and $20,000 to the Governor of Sonora. The Californians thought it wise to accept a third of the money they had paid, and charge the remainder to a lesson in experience.

Another version[7] says the Mulatos mine was worked out when it was sold. It was merely the shell of a mine that had once been richly productive. The manager, Canizeros, thought it a pity that so much nice-looking stuff should be so poor in gold. But that could be remedied by skilful treatment. The waste rock could be transmuted into real ore by means of judicious salting. Why not sell it to the *Americanos*? They liked big bodies of low-grade ore suitable for milling on a large scale. Such ore could be made by means of artificial enrichment. When a mine is salted, obviously the vendor will receive the first payment only; after

[7] John Baragwanath: "Pay Streak," p. 203; 1936.

that will come the exposure. So the mine must be sold for a large sum in cash as soon as the vendor's examination is completed.

Canizeros used finely divided gold; it is said that he drilled holes and put the gold into sticks of dynamite, which when it exploded, would scatter the gold. He peppered the faces of alleged ore with small particles of gold; he inserted the precious metal into crevices; he loaded a sawed-off shotgun with cartridges containing the gold and then fired the gun at the backs of the levels. He was, so it is said, careful not to over-do his salting, for that would arouse suspicion. He was making the similitude of big bodies of low-grade ore easy to treat in a big stamp mill. The Americans loved that kind of mine. They should be given the chance to acquire such a property.

The San Francisco agent, Winceslao Loaiza, of the Aguayo brothers, interested three companies in the business—namely, the Exploration Company, of London, and two American companies controlled by Alvinza Hayward. Alexis Janin examined the mine for the English company, but reported adversely. Apparently, therefore, the salting had not been performed successfully. Then Hayward and his associates took a three months' option at $1,575,000. They sent Daniel Gillette to examine the mine. He arrived with a train of mules, loaded with supplies, including dynamite. Canizeros said he was glad to see the explosive, as he had but little of his own on hand. He suggested that Gillette's dynamite be stored in a stone cabin under lock and key. Before that was done, however, he substituted his own dynamite, salted with enough gold to raise the grade of the supposed ore to $9 per ton. Gillette took some preliminary samples; and the assays, made at the mine, were satisfactory. Systematic sampling was then started. The samples were put into a storehouse, to which Canizeros readily obtained access. Any samples that had previously escaped adulteration were duly enriched, but not too much. Finally Gillette suggested a trial mill-run, as a kind of sampling on a large scale. The yield in the mill averaged nicely about $9 per ton, but this result was due, again, to salting. The Mexican mill workers smoked cigarettes wrapped with corn husk and into these a carefully weighed proportion of gold was placed. When the foreman gave a nod, a little of the gold-bearing ash from a cigarette was flicked into the crusher, into the stamp battery, and upon the amalgamated plates. This was done, it is said, under the very noses of experienced mining engineers, and it was so well done that the ore was enriched slightly, but not too much, to the grade previously indicated by the sampling. This part of the story is most unconvincing, because the addition of gold in this way at several stages of the milling could not be regulated with any approach to a predetermined yield. We are told then that a first payment of $710,000 was made by Hayward to Loaiza, agent of the Aguayos at San Francisco, in August of 1889, and notes for $865,000 were placed in the same gentleman's hands by the purchasers. Thereupon the stamp mill was started to treat 200 tons daily—for a yield of only $3 per ton. The cat was out of the bag. Meanwhile Canizeros went to Guaymas and claimed his $10,000 commission from the Aguayo brothers; they refused to pay him, saying that he had robbed them of more than $10,000 while managing the mine for them. Apparently there was none of the proverbial honesty between these thieves. Thereupon Canizeros went to the new owners of the mine, the victims of his own sharp practice, and arranged for a reward from them of $10,000 in exchange for a complete confession and the production of all the evidence required to cancel the contract between Hayward and the Aguayo brothers. Canizeros remained in San Francisco, out of reach of his former employers, and away from the strong arm of Porfirio Diaz, then President of Mexico. Another engineer was sent to examine the mine and he confirmed the fact of salting. Loaiza returned the promissory notes to Hayward and all the money except $153,000, which had been distributed beyond any chance of recovery.

On the whole this story does not ring true, as regards the salting itself. It assumes too much skill in the accurate distribution of gold in the samples and in the mill ore. If a series of such saltings had been perpetrated, it would have been extremely difficult to make the assay results concordant, and there would have been too many chances of detection by a man as experienced as Gillette. My first version is, I believe, more in accord with the facts.

(To be concluded)

Fibrous Glass Electrical Insulation Discussed

FIBROUS GLASS forms only the structural framework of glass insulating materials, explained J. R. Thumm, Research Laboratories, Owens-Illinois Fiberglas Corp., speaking at a meeting of the West Virginia Section of the American Institute of Electrical Engineers, Charleston, W. Va. He emphasized that glass is a part of the electrical insulation problem and not the alpha and omega of motor insulation. After presenting sound pictures of the manufacture of fibrous glass for electrical insulation, special fabrics, and heat-insulating blankets, he discussed the characteristics of fiber glass structured insulations compared to those built with asbestos and cotton.

Although, as Mr. Thumm pointed out, glass in its solid form is an excellent insulator, most applications require a flexibility which demands a fibrous structure and the spaces must be filled with varnish or other plastic material, the same as with asbestos and cotton. Therein lies a limitation to the degree of prolonged higher temperatures that the fiber glass insulation will stand over cotton insulation. Research is in full swing to discover new impregnating materials which will stand greater heat and add to the scope of applications. He stressed the permanence of glass as an inorganic or "dead" insulation which does not "die again," compared to organic or "living" materials for which a "death" is implied. Until the advent of fibrous glass, mica and asbestos were the only flexible inorganic materials available for electrical insulation. Fiberglas leads the other structural materials by being non-hygroscopic.

Tensile strength per unit of area of very fine glass fibers, those of 0.0002 in. diameter, approaches close to a basic strength of 300,000 lb. per square inch, thus exceeding the tensile of the best steels. As diameters of glass fibers are increased to approach 0.001 in., the strength per square inch drops rapidly, and then, with further increases in size, drops slowly. Thus the reason that fibers of small diameter are used for making glass fabrics is evident.

P. M. Barlow, West Virginia Engineering Co., briefed his observations of applications of glass in mining machinery. This insulation is meeting with success at mines where the standard of maintenance is high. Other applications have demonstrated that the new material is not a cure-all for electrical difficulties caused by low standards of operation and maintenance.

Copper Ore in the United States

Census data reveal interesting characteristics of the industry

RESULTS of the 1939 Census of Mineral Industries, which are beginning to appear in preliminary form, reveal some interesting economic and technical trends in mineral production. The business of mining and treating copper ore, for example, is in the hands of relatively few concerns. Salient statistics for the industry are given in Table I. These figures show that since 1929 there has been a further reduction in the number of producing copper mines. Forty-nine producing mines were reported in 1939, compared with 180 in 1929 and 226 in 1919. The four largest mines, each of which produced over 80,000,000 lb. of recoverable copper, accounted for 44 percent of the total copper mined by copper mines in 1939; the ten largest mines, each of which produced over 40,000,000 lb. of recoverable copper, accounted for 67 percent. Although the 49 copper mines and 25 mills were operated by 34 operating companies, the three major copper companies and their three subsidiaries, operating 19 mines and 11 mills, produced 74 percent of the total output.

The total quantity of recoverable copper in ores and concentrates produced by copper mines and mills in 1939 was 29 percent below that of 1929. About 43 percent of the output came from five open-cut operations and 57 percent from 44 underground mines. Arizona was the leading copper-mining State, accounting for 36 percent of the copper mine and mill output of recoverable copper. Utah produced 24 percent; Montana, 14 percent; Nevada, about 10 percent; New Mexico, 7 percent, and Michigan, over 6 percent.

About 81 percent of the total recoverable copper produced by copper mines and mills in 1939 was contained in concentrates, 12 percent in direct-smelting ore, and the remainder in milling ores sent to other than copper mills and in leached ores and mine-water precipitates. Milling ores were concentrated at 25 copper mills, which treated 51,862,000 short tons of ore (including a small quantity of tailings) and produced 2,108,000 short tons of concentrate. Thus it required an average of about 25 tons of crude ore to produce 1 ton of concentrate. The average recoverable copper content of ore concentrated was 21.5 lb. per ton, or 1.07 percent, compared with 1.22 percent for 1929. It is interesting to note that some of the large porphyry operations which are known to be low-cost producers treated ore yielding as little as 15 lb. of copper per ton of ore. About 19 percent of the mine value of the ore mined and milled during the year was derived from recoverable metals besides copper.

Output per man for the copper-mining industry as a whole increased substantially since 1929. In 1939, 1.3 tons of crude copper ore were mined per man-hour, compared with 0.7 tons in 1929. The recoverable copper content of the ore mined per man-hour in 1939 was 34.2 lb., 67 percent higher than the 1929 figures of 20.5 lb. Combined figures for mining and milling indicate that output per man-hour in 1939 averaged 27 lb. of recoverable copper. The highest man-hour output, about 37 lb., was attained in California, Nevada, and Utah, where open-cut mining is predominant. Arizona and New Mexico ranked next, with an average of 30 lb. per man-hour; output per man-hour in North Carolina, Pennsylvania, and Tennessee averaged 28 lb.; in Montana, Idaho, and Washington, 19 lb.; and in Michigan, 13 lb. Of the total number of man-hours worked, about 79 percent was devoted to mining, mine development, and maintenance, and 21 to milling.

Power equipment available for use at copper mines and mills at the end of 1939 had an aggregate rated capacity of 753,000 hp. The available horsepower per wage earner, including idle and used equipment, was 32 in 1939, compared with 16 in 1929 and 12 in 1919. To a considerable extent this trend reflects a larger use of more efficient power equipment and a wider utilization of mechanical power for tasks formerly performed with manual labor.

The figures for electric-energy consumption indicate a shift to the use of purchased electric power and a decline in the proportion generated at the point of use. Although the consumption of electricity generated at copper mines and mills declined 43 percent between 1929 and 1939, the consumption of purchased electric energy increased by 5 percent, despite a 23 percent drop in the production of crude ore. Purchased energy comprised 66 percent of the total electric energy consumed in 1939, compared with 51 percent in 1929.

Statistics on power-loading machines available for use at the end of 1939 are summarized in Tables II and III for underground and open-cut mines. All of the shovel loaders and half of the scraper loaders were driven by compressed air. The remainder of these machines were driven by electricity.

Table I—Principal Statistics for the Copper-ore Industry, United States, 1939, 1929, 1919

	1939	1929	1919
Number of operating companies	34	....	....
Number of mines	49	180	226
Number of mills	25	....	....
Average number of wage earners	23,840	44,502	43,717
Wages	$34,481,743	$73,199,785	$66,390,194
Number of salaried employees	2,904	3,465	3,179
Salaries	$8,085,135	$10,136,354	$8,039,741
Recoverable metal content			
Copper, millions of lb.	1,386	1,921	1,146
Percent of total recoverable copper reported by Bureau of Mines	95.2	....	....
Gold, fine oz.	429,496	....	....
Silver, fine oz.	13,138,008	....	....
Molybdenum, lb.	7,425,386	....	....
Zinc, lb.	52,840,656	....	....
Lead, lb.	14,431,555	....	....
Average number equivalent full days active			
Mines	303	....	....
Mills	321	....	....
Output per man-hour in mining and milling:			
Recoverable copper, lb.	27.1	....	....
Mine or mill value of all other products ¢	53.4	....	....
Electric energy consumed, thousand hw.-hr.	1,215,510	1,492,733	....
Purchased	798,925	758,119	....
Generated	416,585	734,614	....

Table II — Power-Loading Machines at Underground Copper Mines in the United States, 1939

Shovel loaders, total	147
Requiring head room over 8 ft.	69
Requiring head room 8 ft. or less	78
Scraper loaders, total	420
Electric or diesel-electric	209
Compressed air	211
Under 10 hp.	274
10–25 hp.	138
26–100 hp.	8

Table III—Power Shovels and Draglines at Open-cut Copper Mines in the United States, 1939

Power shovels and draglines, total	77
Steam	1
Electric or diesel-electric	67
Gasoline or diesel	9
Classified by size of dipper (cu.yd.)	
Under 3	17
3–5	59
Over 5	1

USEFUL OPERATING IDEAS

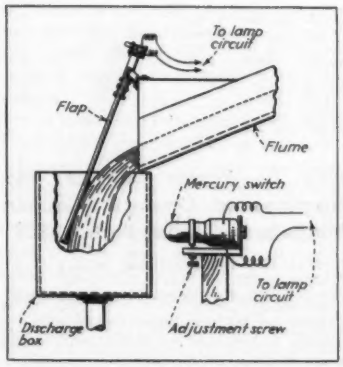
Mercury Switch Alarm

IN METALLURGICAL PLANTS of all kinds there is often need of some sort of telltale alarm to tell whether flows of material are continuous or interrupted, be the materials solids, pulps, solutions, or even clear water. A common method of keeping track of conditions is to suspend a swinging lever in launders, over conveyor belts or other means of conveying material. The motion of this swinging lever, as actuated by the movement of the material in which the free end swings, is used to open or close switches of electrical circuits controlling bell or buzzer alarms, lamps, or motor switches.

Some trouble is experienced with the switches ordinarily used, by reason of corrosion, coating with dirt, or even plain mechanical misalignment. L. D. Anderson, consulting engineer, Potash Company of America, Carlsbad, N. M., notes that these troubles can be avoided and much neater arrangements effected if there be fastened to the swinging lever the type of switch consisting of a tube with a terminal at each end, in which is a bit of mercury. The tipping of this tube causes the mercury to move inside the tube, making or breaking electrical circuits. The leads to the tube may be of flexible wire, permitting extreme motion of the tube. The tube itself may be mounted in such a manner as to permit adjustment of its inclination.

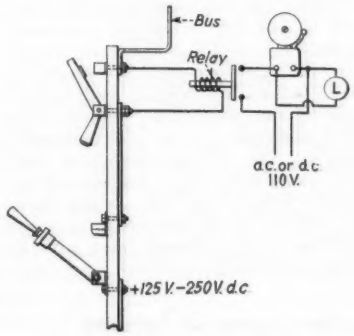
These tubes, once made of glass, are now available in sturdy metal construction. They have ample current-carrying capacity for buzzers, alarm bells, and even small motors. For very large motors, relays may be used between these mercury switches and the motor switches, although many magnetic switches are so built as to require no more current for their actuating magnets than can be handled by these mercury switches. Connections can be made either to start or stop motors, as conditions may require, by the movement of the swinging lever.

It will be clear that the use of totally inclosed mercury switches of the type mentioned will eliminate troubles occasioned by dusty, corrosive atmospheres. The photo-electric switch is also used for the same purpose as the swinging lever, although the latter is probably the simpler arrangement for most conditions.



Power Outage Indicator

THE modern mine hoist room and power house is becoming increasingly more noisy with each new installation of contractor-controlled, electrically powered machinery. It is



this clatter of control panels which renders it difficult for the attendant to be aware instantly of the opening of circuit breakers, particularly those in the mine haulage service.

While many maintenance men have improved on the situation by drilling the panel slate and installating a switch-type telephone receiver device so that it is operated by the braker when in the open position, this arrangement is not entirely satisfactory. This type of "homemade" device is an eye-sore, compared with the other panel equipment, and the light switch springs and contacts are a frequent source of trouble.

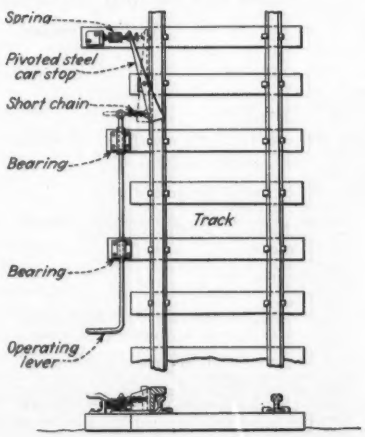
Having gone through the trial by error process, writes P. C. Ziemke, Milwaukee, Wis., the problem was eventually solved by installing a relay whose windings shunted the gap normally kept closed by the breaker. Thus, when the breaker operates, current flows through the relay and it, in turn, functions to sound a bell or horn or to flash a light.

The back-panel board wiring is inconspicuous and the small-size relay is easily mounted in a cabinet for both good appearance and safety. There is always sufficient line leakage to operate the relay, even though ordinary loads are momentarily off.

Dependable Car Stop

TO INSURE safe and continuous hoisting of ore and waste through inclines, installation of a reliable car stop on the surface is essential. Numerous accidents occur every year by using unsafe contrivances which fail to prevent possible unattached mine cars from rolling down into the shaft. At the properties of United States Vanadium Corporation, Uravan, Colo., where production is hoisted to the surface through 22-deg. shallow inclines, maximum safety is obtained with a recently developed car stop, explained in the accompanying sketch.

The novel feature is the application of a pivotal steel stop actuated by a simple foot lever to provide a positive barrier for the approaching mine car. It is installed a short distance from the mine entrance in view of the hoist man, with the stop proper constantly



in a closed position. While the stop is automatically opened by the pressure of the wheels of the ascending car, passage of the descending car can be effected only by pressing down the end of the operating lever, thus opening the stop.

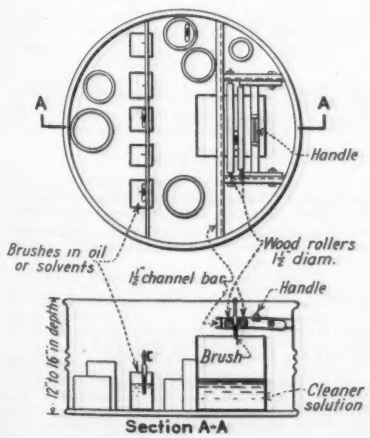
As shown in the illustration the entire installation consists of: (1) a pivotal steel stop held in a closed position by a tension spring, and (2) an operating lever resting in two simple bearings on the rail sleepers and attached to the lower end of the steel stop by a short piece of chain. All parts were made at the company shop from scrap.

▼

For Paint Brushes

A CONTAINER devised to insure the safety of paint brushes, avoid costly replacements, and keep the brushes in usable condition the year round is described by K. N. Banthin, of Oak Park, Ill. As shown in the sketch, it was made by cutting down to about 14 in. in height a 55-gal. lock-rim steel drum, the bottom of which was cut out and rewelded to the 14-in. section. Out of 1½-in. angle iron, with a short section of flat stock and two 1½-in. diameter wooden rollers, a small pressure wringer was constructed on one side of the container. Another section of flat stock with ⅛-in. steel pins through it was welded in, from which to hang the brushes into special solvent or paint containers.

Through each brush handle a ¼-in. hole was drilled. Under the wringer was placed a cut-down 5-gal. square can for holding the initial rinse used on the brushes before putting them in separate solvents. This large container was selected so that it could hold a number of cans of different sizes containing various solvents in which the brushes could be suspended to the correct depth. Thus, mixing of colors can be avoided and solvent evaporation minimized.



Lubricating Wire Rope

G. E. MacQueen

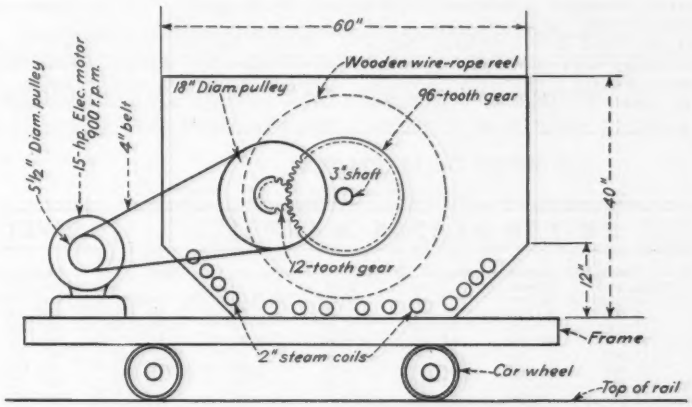
LIKE ANY MACHINE with moving parts, wire rope must be thoroughly lubricated internally and externally if it is to perform satisfactorily. When it is realized that a 6x19 hemp-center rope has a total of 114 wires, or 6x16 filler wire rope a total of 96 wires, not including the 5 filler wires, it will be clear that continual movement of the parts of such a "wire machine" produces bearing surfaces beyond accurate calculation. That these surfaces require lubrication is self-evident.

I observed recently at the Cresson shaft in the Cripple Creek district, Colo., a novel and efficient method of lubricating mine hoist ropes. The scheme was devised by Guy Rorabaugh, general master mechanic for the Cresson Consolidated Gold Mining & Milling Co., and is in use at several shafts in the district. At the Cresson shaft two wire ropes are in use, each 1⅞ in. in diameter and 2,550 ft. long. They are 6x16 filler-wire construction, plow-steel grade, preformed in right regular lay. Hoisting speed is 1,400 f.p.m., and the rope overwinds on itself for four layers on 72-in. tread diameter drums.

As shown in the accompanying drawing, the lubricating equipment consists of a sheet-steel tank 40 in. deep, 48 in. wide, and 60 in. long, mounted on a mine-car chassis. A corrugated sheet-iron cover is provided for the tank to prevent splash and keep out moisture. In the bottom of the tank are 14 2-in. steam coils disposed as illustrated. Mounted within the tank on a 3-in. shaft is a wooden reel to receive the rope to be treated. Simple packing glands are provided where the shaft passes through the tank. A 96-tooth gear is on the driven end. Power is furnished by a 15-hp. motor running at 900 r.p.m., connected by 4-in. belt with an 18-in. pulley and 12-tooth gear mounted on a countershaft. No provision is made for tightening the motor belt, but the motor is wedged in the desired position.

When rope is to be lubricated, the unit is placed in position at the collar of the shaft, with about 150 lb. of vitalife No. 1 wire rope lubricant in the tank. This quantity makes the tank about half full. Steam is then turned into the coils, and the discharge valve is cracked just enough to remove the condensate. The temperature of the lubricant will rise to about 200 deg. F. before the rope is reeled into the tank, when it will fall to about 185 deg. F. Heating is continued throughout the process.

The shaft skip or counterweight is brought to the collar of the shaft and blocked in that position. The wire rope is detached from the skip and attached to the reel in the treatment tank, taking care to avoid abuse of the rope by kinking or opening the lays. Then the hoist drum is slacked off and the rope is wound loosely on the reel up to its capacity. Usual treatment requires 1½ hr., but the rope is allowed to remain in the tank until it is uncomfortably hot to the touch.



It is customary to give this treatment at intervals of six weeks, but it should be given oftener if inspection makes it advisable. Between treatments the rope is never permitted to become dry. Frequently, after treating the counterweight rope, 600 to 700 ft. of the skip rope may be treated, even before it shows the need. Usually such treatment of 1,800 ft. of rope will pick up about 10 gal. of lubricant, or about 2 percent of the weight of the rope treated.

Results obtained by this equipment and method, according to my observation, were excellent, and the lubricant seemed to be reaching the interior of the individual strands as well as to the hemp center. Wires were bright and in good condition, with no evidence of corrosion or rust.

Summary of the

MARKETS

THE process of stabilizing prices of basic raw materials made further advances during April. Outstanding in developments, though not in the field encompassed by non-ferrous metals, was the freezing of steel prices soon after higher wage rates were granted in that important industry. An unexpected price warning on lead was issued early in the month, in which it was declared that a price ceiling may be necessary unless producers refrain from further increases in the price. The question of establishing a uniform quotation on copper was the subject of a general meeting in Washington. Dealers who have been selling cadmium at a steep premium over the producers' price were rebuked by the price policing division.

Quotations varied little during April. The *E&M.J.* index of prices for the month was 83.48, against 83.27 in March and 77.19 in April, 1940.

Toward the end of the month it was stated officially that a formal price schedule would not be imposed on the copper industry at this time, but it was made known that the goal of the industry should be a uniform 12c. Valley basis. Large mine operators held to 12c., but some small producers and custom smelters sold moderate tonnages at higher levels. Deliveries of copper to domestic consumers for March reached the record total of 134,333 tons, of which 31,201 tons consisted of foreign metal released by the Metals Reserve Company. The Government's agency has released 56,000 tons of foreign copper for April. Sales by producers to the domestic trade in April involved 88,203 tons.

Lead demand was active in spite of the price warning. Consumption has been expanding and inventories are being enlarged. The quotation continued at 5.85c., New York.

The defense "pool" in zinc has been increased to 17 percent of total output. Call for zinc has not subsided and the industry still fears that full priorities may yet be imposed.

Quicksilver was a little easier on freer offerings, following the recent price warning.

UNITED STATES MARKET

1941 April	Electrolytic Copper: Domestic (a) Refinery	Electrolytic Copper: Export (b) Refinery	Straits Tin: New York	Lead: New York	Lead: St. Louis	Zinc: St. Louis
1	11.800	10.950	51.625	5.85	5.70	7.25
2	11.800	10.950	51.500	5.85	5.70	7.25
3	11.925	10.900	51.625	5.85	5.70	7.25
4	11.900	10.950	51.750	5.85	5.70	7.25
5	11.850	11.000	51.750	5.85	5.70	7.25
7	11.875	10.950	51.750	5.85	5.70	7.25
8	11.825	10.950	51.625	5.85	5.70	7.25
9	11.825	10.950	51.625	5.85	5.70	7.25
10	11.775	10.950	51.750	5.85	5.70	7.25
11	11.850	10.950	52.000	5.85	5.70	7.25
12	11.850	10.950	52.000	5.85	5.70	7.25
14	11.825	10.950	52.000	5.85	5.70	7.25
15	11.775	10.950	52.000	5.85	5.70	7.25
16	11.775	10.950	52.375	5.85	5.70	7.25
17	11.775	10.950	52.250	5.85	5.70	7.25
18	11.775	10.950	52.250	5.85	5.70	7.25
19	11.850	10.950	52.500	5.85	5.70	7.25
21	11.775	10.950	52.500	5.85	5.70	7.25
22	11.775	10.950	52.375	5.85	5.70	7.25
23	11.850	10.950	52.375	5.85	5.70	7.25
24	11.775	10.950	52.250	5.85	5.70	7.25
25	11.850	10.950	52.125	5.85	5.70	7.25
26	11.900	10.950	52.000	5.85	5.70	7.25
28	11.775	11.000	51.750	5.85	5.70	7.25
29	11.775	10.950	51.750	5.85	5.70	7.25
30	11.800	10.950	52.000	5.85	5.70	7.25
AVERAGES FOR MONTH						
April	11.820	10.952	51.981	5.850	5.700	7.250
AVERAGES FOR WEEK						
April 2	11.825	10.825	52.208	5.850	5.700	7.250
9	11.867	10.950	51.688	5.850	5.700	7.250
16	11.808	10.950	52.021	5.850	5.700	7.250
23	11.800	10.950	52.375	5.850	5.700	7.250
30	11.813	10.958	51.979	5.850	5.700	7.250
CALENDAR WEEK AVERAGES						
April 5	11.850	10.908	51.729	5.850	5.700	7.250
12	11.833	10.950	51.792	5.850	5.700	7.250
19	11.796	10.950	52.229	5.850	5.700	7.250
26	11.821	10.950	52.271	5.850	5.700	7.250

SILVER, GOLD AND STERLING EXCHANGE

1941 Apr.	Sterling Exchange: "Checks" (Nominal)	Sterling Exchange: "90-day demand"	Silver: (c) New York	Silver: London	Gold: London	Gold: (d) United States
1	401.500	(f)	34.750	23.5000	168s	$35.00
2	402.000	(f)	34.750	23.5000	168s	35.00
3	401.500	(f)	34.750	23.5000	168s	35.00
4	401.500	(f)	34.750	23.5000	168s	35.00
5	401.000	(f)	(e)	(e)	(e)	35.00
7	402.000	(f)	34.750	23.5000	168s	35.00
8	401.500	(f)	34.750	23.5000	168s	35.00
9	401.500	(f)	34.750	23.5000	168s	35.00
10	401.500	(f)	34.750	23.5000	168s	35.00
11	401.500	(f)	34.750	23.5000	168s	35.00
12	401.500	(f)	(e)	(e)	(e)	35.00
14	401.500	(f)	34.750	Holiday	Holiday	35.00
15	401.500	(f)	34.750	23.5000	168s	35.00
16	401.000	(f)	34.750	23.5000	168s	35.00
17	400.000	(f)	34.750	23.5000	168s	35.00
18	400.000	(f)	34.750	23.5000	168s	35.00
19	400.000	(f)	(e)	(e)	(e)	35.00
21	401.000	(f)	34.750	23.5000	168s	35.00
22	401.000	(f)	34.750	23.5000	168s	35.00
23	400.000	(f)	34.750	23.5000	168s	35.00
24	400.000	(f)	34.750	23.5000	168s	35.00
25	401.500	(f)	34.750	23.5000	168s	35.00
26	401.000	(f)	(e)	(e)	(e)	35.00
28	401.000	(f)	34.750	23.5000	168s	35.00
29	401.000	(f)	34.750	23.5000	168s	35.00
30	400.000	(f)	34.750	23.5000	168s	35.00
AVERAGES FOR MONTH						
Apr.	401.058	.....	34.750	23.5000	....	35.00
AVERAGES FOR WEEK						
Apr. 2	401.583	.....	34.750	.....	....	.....
9	401.500	.....	34.750	.....	....	.....
16	401.417	.....	34.750	.....	....	.....
23	400.333	.....	34.750	.....	....	.....
30	400.750	.....	34.750	.....	....	.....

Calendar week averages, New York Silver: April 5th, 34.750; 12th, 34.750; 19th, 34.750; 26th, 34.750.

(e) Not quoted (Saturday). (f) No quotations.

THE above quotations for major non-ferrous metals are our appraisal of the important United States markets, based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis, as noted. All prices are in cents per pound.

(a) Net prices at refineries on Atlantic seaboard. To arrive at the delivered New England basis add 0.225c. per pound, the average differential for freight and delivery charges.

(b) Export prices are net at refineries on the Atlantic seaboard and include sales of domestic copper in the foreign market. Owing to the European War and the disruption of normal trade relations, our export copper quotations, since September, 1939, have been based largely on f.a.s. transactions, ex United States ports. To arrive at the f.o.b. refinery quotations deduct .05 from the f.a.s. basis for lighterage.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

Quotations for copper are for the ordinary forms of wirebars and ingot bars; cathodes are sold at a discount of 0.125c.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York commands a premium over the St. Louis basis equal to the freight differential. Contract prices for High Grade Zinc delivered in the East and Middle West in nearly all instances command a premium of 1c per pound over the current market for Prime Western but not less than 1c over the *Engineering and Mining Journal's* average quotation for Prime Western for the previous month.

Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

(c) Silver other than newly-mined domestic, by Handy & Harman. Under Treasury order of July 6, 1939, the price on domestic newly-mined silver mined subsequent to July 1, 1939, was fixed at 71.11c per troy ounce. Handy & Harman's quotation on newly-mined domestic silver, 999 fine was 70⅝c throughout April.

(d) U. S. Treasury's gold price. Actual payment by the United States Treasury for gold in domestic and imported ore or concentrate is at 99.75 per cent of the price quoted by the Treasury, which at present is equal to $34.9125.

LONDON MARKET

April, 1941	Tin—Standard—Spot	Tin—Standard—3 months
1	270.0000	266.7500
2	268.0000	265.0000
3	267.7500	265.2500
4	268.5000	266.5000
7	269.0000	266.7500
8	268.5000	265.7500
9	267.5000	264.7500
10	268.2500	265.5000
11	Holiday	
14	Holiday	
15	269.7500	267.5000
16	270.7500	268.0000
17	271.0000	267.5000
18	271.7500	266.7500
21	271.0000	267.0000
22	271.0000	267.0000
23	270.7500	266.7500
24	271.2500	267.0000
25	271.7500	267.0000
28	270.5000	266.2500
29	269.2500	265.7500
30	269.2500	266.7500
Average	269.775	.....

Official tin prices on London Metal Exchange in long tons, pound sterling. Trading in copper, lead, and zinc suspended August 31, 1939.

Weekly MARKET INFORMATION Service

- E&MJ Metal & Mineral Markets, the weekly price information service of Engineering & Mining Journal, will keep you in close touch with effects of war developments on costs and availability of metals and non-metallic minerals.
- Printed and mailed every Wednesday night, E&MJ Metal & Mineral Markets will speed to you as special newspaper mail. It carries daily and weekly average prices of metals for the preceding six market days.
- Rates: $5 a year in the United States and possessions, and in the Americas; $10 a year elsewhere. Address:

E&MJ METAL & MINERAL MARKETS

Dept. 101 330 West 42nd Street New York, N. Y.

CURRENT PRICES — MISCELLANEOUS METALS, ORES, AND NON-METALLIC MINERALS

Quotations cover wholesale lots, prompt shipment, f.o.b. New York, unless otherwise stated

(May 1, 1941)

MISCELLANEOUS METALS

Aluminum, ingot, 99 plus per cent, lb	17c.
Antimony, domestic, spot, lb	14.00c.
Bismuth, ton lots, lb	$1.25
Cadmium, commercial sticks, lb	90c.
Calcium, lb., ton lots 97 @ 98 per cent	Nominal
Chromium, 97 per cent grade, lb	89c.
Cobalt, 97 to 99 per cent, per lb	$1.50
Nickel, electrolytic cathodes, lb	35c.
Magnesium, 99.8 per cent, carloads, lb	27c.
Palladium, troy oz	$24.00
Platinum, (Official quotation) troy oz	$36.00
Quicksilver, flask of 76 lb., 100 flasks or more	$179.00
Radium, mg. radium content	$25.00@$30.00
Selenium, 99.5 per cent, lb	$1.75
Silicon, minimum 97 per cent, spot, lb	16.50c.
Tellurium, lb	$1.75
Thallium, 100 lb. or more, lb	$10.00
Titanium, 96 to 98 per cent, lb	$5.00

METALLIC ORES

Beryllium Ore, f.o.b. mines, ton	$30.00@$35.00
Chrome Ore, 48 @ 50% Cr_2O_3 c.i.f. Atl. ports, long ton	(b)$42.00@$43.00
Iron Ore, Lake Superior, Lower Lake ports, long ton:	
Old Range bessemer	$4.75
Mesabi bessemer	$4.60
Old Range non-bessemer	$4.60
Mesabi, non-bessemer	$4.45
Lead (Galena) 80 per cent, Joplin, Mo., ton	$69.58
Manganese Ore, (foreign) c.i.f. U.S. ports, long ton unit of Mn:	
52 @ 55 per cent	(b) 70c.
50 @ 52 per cent	(b) 70c.
46 @ 48 per cent	(b) 65c.
Molybdenum Ore, 90%, per lb. of MoS_2, f.o.b. mines	45c.
Tungsten Ore, per unit of WO_3:	
Chinese, 65 per cent, duty paid	(b) $24.00
Domestic, 65 per cent and upward	(a) $23.50
Vanadium Ore, per lb. of contained V_2O_5	27½c.
Zinc Ore, Prime, 60 per cent concentrate, Joplin, Mo.; per ton	$48.00

(a) Prices at mines, small lots, usually several dollars less. (b) Nominal.

METALLIC COMPOUNDS

Arsenious Oxide (arsenic) lb	3½c
Cobalt Oxide, 70 @ 71 per cent, lb	$1.84
Copper Sulphate, 100 lb	$4.75
Sodium Nitrate, ex vessel, in 200-lb. bags, per 100 lb	$1.42
Sodium Sulphate, bulk ton	$18.00@$22.00

ALLOYS

Beryllium Copper, master alloy, 2.5 to 3 per cent Be, per lb. of contained Be	$15.00
Ferrochrome, 65 @ 70 per cent chromium, 4 @ 6 per cent carbon, per pound of Cr contained	11c.
Ferromanganese, 78 @ 82 per cent, gross ton	$120.00
Ferromolybdenum 55 @ 65 per cent Mo. lb. of Mo. contained	95c.
Ferrosilicon, 50 percent, gross ton	$74.50
Ferrotungsten, 75 @ 80 per cent, lb. of W contained	$1.90@$2.00
Ferrovanadium, per lb. of V, delivered	$2.70@$2.90

NON-METALLIC MINERALS

Asbestos, f.o.b. mines (U.S. funds), ton:	
Canadian (Quebec)	
Crude No. 1	$700@$750
Crude No. 2	$150@$350
Spinning fibers	$110@$200
Paper stock	$40@$49
Shorts	$13@$17.50
Vermont	
Shingle stock	$57
Paper stock	$40
Cement stock	$25
Barytes, long ton:	
Georgia, crude	$8.00
Missouri, 93 per cent $BaSO_4$, less than 1 per cent iron	$6.00@$6.50
Bauxite, long ton:	
Domestic, chemical, 55 @ 58 per cent	$7.00@$8.00
Domestic, abrasive, 80 @ 84 per cent	$14.00
China Clay, f.o.b. mines, ton:	
South Carolina and Georgia, No. 1, bulk	$6.75@$8.00
Delaware, No. 1	$14.50
Feldspar, bulk, ton:	
Potash feldspar, 200 mesh	$17.00
Glass-spar, white, 20 mesh	$11.75
Fluorspar, f.o.b. mines, bulk, Kentucky and Illinois 85–5 per cent, all rail movement, ton	$20.00
Ground, 95 @ 98 percent, bulk, ton	$31.00
Lump, acid, 98 percent, bulk, ton	$27.00
Fuller's earth, f.o.b. Georgia or Florida, ton	$7.00@$14.00
Magnesite, per ton:	
Dead-burned, f.o.b. California	$25.00
Dead-burned, f.o.b. Washington	$22.00
Mica, per lb., North Carolina, No. 1 and 2 quality:	
1½ x 2 in.	45@60c.
2 x 2 in.	60@80c.
3 x 3 in.	$1.25@$1.50
3 x 4 in.	$1.50@$1.75
3 x 5 in.	$1.75@$2.25
White, ground, 70 mesh, ton	$60.00@$80.00
Ocher, Georgia, ton	$19.00@$22.00
Pyrites, Spanish, per long ton unit of S, c.i.f. Atlantic ports	(a) 12c.
Silica, in bags, 325 mesh, ton	$20.00@$40.00
Sulphur, Texas, mines, long ton	$16.00
Talc, f.o.b. works, ton:	
New York, double air-floated, 325 mesh	$12.00@$15.00
New Jersey, mineral pulp	$8.50@$10.50
Vermont, extra white, 200 mesh	$9.50@$10.00
Tripoli, Missouri, ton:	
40 mesh, cream colored	$14.50
200 mesh, cream colored	$26.00

(a) Nominal

IRON AND STEEL

Pig Iron, Valley furnaces, gross ton:	
Bessemer	$24.50
Basic	$23.50
No. 2 Foundry	$24.00
Steel, base prices, Pittsburgh:	
Billets, gross ton	$34.00
Structural shapes, 100 lb	$2.10
Bars, 100 lb	$2.15

Monthly and Yearly

AVERAGE PRICES

SILVER AND STERLING EXCHANGE

	New York		London Spot		Sterling Exchange	
	1940	1941	1940	1941	1940	1941
January	34.750	34.750	21.892	23.273	395.442	(a) 402.000
February	34.750	34.750	20.935	23.341	395.652	(a) 401.864
March	34.750	34.750	20.763	23.446	375.212	(a) 401.788
April	34.750	34.750	20.713	23.500	351.817	(a) 401.058
May	34.949	.....	21.878	.....	326.452	.....
June	34.825	.....	22.688	.....	359.560	.....
July	34.750	.....	22.095	.....	379.750	.....
August	34.750	.....	23.261	.....	396.889	.....
September	34.750	.....	23.446	.....	401.646	.....
October	34.750	.....	23.451	.....	401.692	.....
November	34.750	.....	23.238	.....	401.783	.....
December	34.750	.....	23.015	.....	402.000	.....
Year	34.773	.....	22.281	.....	382.325	.....

New York quotations for silver other than newly-minded domestic, cents per ounce troy, 999 fine, London pence per ounce sterling silver 925 fine. Sterling exchange (pound sterling) in cents. (a) Nominal.

COPPER

	F.O.B. Refinery, Electrolytic			
	Domestic		Export	
	1940	1941	1940	1941
January	11.954	11.819	11.999	10.257
February	11.148	11.794	11.471	10.414
March	11.160	11.814	11.407	10.592
April	11.087	11.820	11.258	10.952
May	11.079	.....	11.191	.....
June	11.128	.....	11.216	.....
July	10.564	.....	10.189	.....
August	10.708	.....	9.851	.....
September	11.296	.....	9.849	.....
October	11.826	.....	10.436	.....
November	11.800	.....	10.084	.....
December	11.802	.....	10.293	.....
Year	11.296	.....	10.770	.....

New York quotations, cents per pound.

LEAD

	New York		St. Louis	
	1940	1941	1940	1941
January	5.471	5.500	5.321	5.350
February	5.076	5.602	4.926	5.452
March	5.192	5.765	5.042	5.613
April	5.071	5.850	4.921	5.700
May	5.015	.....	4.865	.....
June	5.000	.....	4.850	.....
July	5.000	.....	4.850	.....
August	4.854	.....	4.704	.....
September	4.929	.....	4.779	.....
October	5.308	.....	5.158	.....
November	5.726	.....	5.578	.....
December	5.500	.....	5.350	.....
Year	5.179	.....	5.029	.....

New York and St. Louis quotations, cents per pound.

TIN

	Straits New York		Standard, Spot London	
	1940	1941	1940	1941
January	46.707	50.154	240.716	256.648
February	45.851	51.293	242.833	264.975
March	47.079	52.067	251.711	270.131
April	46.815	51.981	252.080	269.775
May	51.570	.....	264.098	.....
June	54.618	.....	273.438	.....
July	51.591	.....	265.592	.....
August	51.176	.....	262.455	.....
September	50.348	.....	251.024	.....
October	51.490	.....	257.946	.....
November	50.577	.....	258.214	.....
December	50.101	.....	256.988	.....
Year	49.827	.....	256.425	.....

New York quotations, cents per pound. London, pounds sterling per long ton.

ZINC

	St. Louis		
	1939	1940	1941
January	4.500	5.644	7.250
February	4.500	5.534	7.250
March	4.500	5.750	7.250
April	4.500	5.750	7.250
May	4.500	5.803	.....
June	4.500	6.235	.....
July	4.516	6.250	.....
August	4.719	6.389	.....
September	6.104	6.920	.....
October	6.500	7.250	.....
November	6.500	7.250	.....
December	5.980	7.250	.....
Year	5.110	6.335	.....

St. Louis quotations, Prime Western, cents per pound.

CADMIUM AND ALUMINUM

	Cadmium		Aluminum	
	1940 (a)	1941 (a)	1940	1941
January	79.038	80.000	20.000	17.000
February	80.000	82.273	20.000	17.000
March	80.000	89.038	19.769	17.000
April	80.000	90.000	19.000	17.000
May	80.000	.....	19.000	.....
June	80.000	.....	19.000	.....
July	80.000	.....	19.000	.....
August	80.000	.....	18.000	.....
September	80.000	.....	18.000	.....
October	80.000	.....	18.000	.....
November	80.000	.....	17.522	.....
December	80.000	.....	17.000	.....
Year	79.920	.....	18.691	.....

Aluminum in cents per pound, 99 plus per cent grade. Cadmium, cents per pound. (a) Producers' price, commercial sticks.

ANTIMONY, QUICKSILVER, AND PLATINUM

	Antimony (a) New York		Quicksilver (b) New York		Platinum (c) New York	
	1940	1941	1940	1941	1940	1941
January	14.000	14.000	156.962	165.846	40.000	36.000
February	14.000	14.000	178.000	170.182	40.000	36.000
March	14.000	14.000	180.921	177.692	40.000	36.000
April	14.000	14.000	173.538	180.077	38.923	36.000
May	14.000	.....	181.538	.....	38.000	.....
June	14.000	.....	197.360	.....	38.000	.....
July	14.000	.....	194.423	.....	38.000	.....
August	14.000	.....	184.111	.....	38.000	.....
September	14.000	.....	173.333	.....	36.167	.....
October	14.000	.....	168.846	.....	36.000	.....
November	14.000	.....	168.391	.....	36.000	.....
December	14.000	.....	164.960	.....	36.000	.....
Year	14.000	.....	176.865	.....	37.924	.....

(a) Antimony, cents per pound, ordinary brands, in cases; in bulk f.o.b. Laredo, Tex., 13.000 for February. (b) Quicksilver, dollars per flask of 76 lb. (c) Platinum, per ounce troy.

PIG IRON

	Bessemer		Basic		No. 2 Foundry	
	1940	1941	1940	1941	1940	1941
January	23.50	24.50	22.50	23.50	23.00	24.00
February	23.50	24.50	22.50	23.50	23.00	24.00
March	23.50	24.50	22.50	23.50	23.00	24.00
April	23.50	24.50	22.50	23.50	23.00	24.00
May	23.50	.....	22.50	.....	23.00	.....
June	23.50	.....	22.50	.....	23.00	.....
July	23.50	.....	22.50	.....	23.00	.....
August	23.50	.....	22.50	.....	23.00	.....
September	23.50	.....	22.50	.....	23.00	.....
October	23.50	.....	22.50	.....	23.00	.....
November	23.50	.....	22.50	.....	23.00	.....
December	23.50	.....	22.50	.....	23.00	.....
Year	23.500	.....	22.500	.....	23.000	.....

Iron, dollars per long ton. F.o.b. Mahoning and Chenango Valley furnaces.

PERSONAL ITEMS

W. E. Everitt recently left England to accept an appointment as Inspector of Mines of Malaya.

P. G. F. Money has joined the staff of Wright-Hargreaves Mines, Ltd., at Kirkland Lake, Ontario.

W. J. Morley has been appointed State Mining Engineer and Chief Inspector of Mines for Queensland, Australia.

S. Power Warren is in charge of a new 100-ton tungsten mill of the Golconda Syndicate at Golconda, Humboldt County, Nev.

Ellsworth Y. Dougherty, consulting geologist, recently of Toronto, has gone to the State of Washington, where his address is R. 2, Box 600, Bellevue, Wash.

Max Crowell, field engineer during the past year for the Nevada State Bureau of Mines, has joined the staff of the U. S. Bureau of Mines station at Boulder City, Nev.

Fraser D. Reid, a prominent Canadian mining engineer and an alumnus of Queen's University, at Kingston, Ont., will receive an honorary LL.D. degree from the University on May 15.

Harve I. Ashby has left the Philippine Islands, where he was associated with the San Mauricio Mining Co., and can be reached for a time at 1627 Cook St., Denver, Colo.

Robert E. Doherty, president of Carnegie Institute of Technology, has been appointed chairman of the Production Planning Board of the Office of Production Management.

J. A. Richards, formerly general superintendent of Consolidated Coppermines, Kimberly, Nev., has been appointed mine superintendent to Mammoth-St. Anthony, Ltd., Tiger, Ariz.

Walter W. J. Croze, geologist of the Oliver Iron Mining Co., Duluth, recently retired from the company following 44 years of service. Mr. Croze has made extensive examinations in South America, Asia and Africa.

Hilary W. St. Clair, formerly assistant metallurgist at the Salt Lake City branch of the U. S. Bureau of Mines, has also been appointed chief engineer to correlate the investigation of light metals—magnesium and alunite.

Capt. W. J. Barrows, president of the Silver Palace Mining Co. at Grantsville, an old Nye County, Nev., silver camp, and pilot of trans-Pacific Clipper planes, has been at the Nevada mine, where milling was resumed recently.

P. H. Reagan, consulting mining engineer of La Paz, Bolivia, has been appointed consulting mining engineer to the U. S. Geologic Survey in its study of the strategic mineral resources of Bolivia—namely tin, tungsten and antimony.

H. E. Hendryx, of Baker, Oregon, has been elected president of Eastern Oregon Mining and Mineral Association, succeeding **Walter E. Garvin,** who served in 1940. Mr. Hendryx is publisher of the *Oregon Mining Review.*

George W. Rust, formerly geologist to Cerro de Pasco Copper Corp., in Peru, is now supervising engineer of the mining section of the Reconstruction Finance Corp. at San Francisco.

Charles Will Wright, of the staff of the U. S. Bureau of Mines, has been recalled from Rio de Janeiro to confer on problems of the National Defense Commission.

A. G. Roach has resigned as superintendent of the 250-ton mill of Seal Harbor Gold Mines, at Goldboro, N. S., to accept a similar position with the 500-ton mill under construction for Jerome Gold Mines, in Ontario.

C. D. Clarke is returning to the United States from Baguio, P. I., where he was mine superintendent for Suyoc Consolidated Mining Co. His address will be Downey, Calif.

J. Howard Hell, mine superintendent for Marsman & Co. at Tagkawayan, P. I., is spending six months on vacation in the United States. He can be reached at Rolla, Mo.

George L. Cornwall, until recently mill superintendent of Cariboo-Hudson Gold Mines, near Barkerville, B. C., is now mill superintendent of Sand River Gold Mining Co., at Beardmore, Ont.

S. D. Strauss, formerly of the staff of *E.&M.J.* and more recently associated with Standard Statistics as metals economist, has joined the Federal Loan Agency at Washington, D. C., as an assistant to **W. L. Clayton,** Deputy Federal Loan Administrator.

Robert William Wilson, after eight years' work in Bolivia, has become associated with the Certain-teed Products Corporation. He will make his headquarters in the Buffalo office of that corporation for about three months, after which he will be located at one of its mines.

Laurie L. McDaniel, general foreman of the smelter division of the Copper Queen branch of Phelps Dodge Corp. at Douglas, Ariz., has been transferred to Morenci, in the same state, where a new smelter, of which Mr. McDaniel will on its completion become superintendent, is in course of construction.

Walter Rex Storms, mining engineer, with Mrs. Storms, recently arrived in the United States from the Philippines, for a six months' vacation. **Mr. Storms** is associated with the mining department of Elizalde & Co., operating in the Philippines.

Harlowe Hardinge, president and general manager of Hardinge Co., Inc., and Mrs. Hardinge, recently spent a vacation touring the Southwestern States and Mexico. They remained several weeks in Mexico, returning home to York, Pa., the latter part of April.

J. J. Beeson, geologist of Salt Lake City, lately joined with **Walter R. Landwehr,** geologist for the A. S. & R. Co., **Erich J. Schrader,** independent geologist of Reno, and **L. S. Breckon,** chief geologist for the Utah Copper Co., in an investigation of geology of the Rip Van Winkle mine, in Elko County, Nev., where early resumption of milling is in prospect.

H. F. Lynn and **J. M. Ehrhorn,** mining engineers and geologists, announce the establishment of their offices at 503 Mills Building, San Francisco. Mr. Lynn was geologist for several years with Idaho Maryland Mines Corp. in Grass Valley, Calif., and Mr. Ehrhorn was superintendent at that company's Midas unit near Forbertown, Calif. During the last two years both have been engaged in consulting work.

Ernest Klepetko, metallurgist, has been appointed by **Dr. R. S. Dean,** chief engineer of the metallurgical division, U. S. Bureau of Mines, at Salt Lake City, to be chief engineer to supervise the hydrometallurgy of manganese ores and electrolytic processing to be used at the $525,000 plant being constructed at Boulder City, Nev., by the Galigher Co., of Salt Lake City.

Daniel Cowen Jackson, president of Utah Copper Co. and managing director for mining operations for the Kennecott Copper Corp., was on April 17 presented with a certificate of honorary membership in the A.I.M.E. The award was for "preeminent leadership in the profession of engineering; for encouragement and inspiration to young men beginning an engineering career; for devoted service in building the Institute and increasing its prestige."

Charles B. Strachan, who had been general superintendent of the American Zinc Company of Tennessee at Mascot, Tenn., since 1918, has retired. After an extended vacation, he will remain with the parent company, the American Zinc, Lead & Smelting Co., in an advisory capacity. **Harley A. Coy,** mine superintendent since 1915, has been promoted to the post of general superintendent. **William Black,** who has been assistant mine superintendent, will succeed Mr. Coy as mine superintendent.

James W. Wade, of Salt Lake City, vice president and general manager of the Tintic Standard Mining Co., and president and general manager of the Eureka Standard Consolidated Mining Co. and Eureka Lily Consolidated Mining Co., is general chairman of the program committee for the eighth annual Metal Mining Convention and Exposition of the American Mining Congress to be held at the Fairmont Hotel, San Francisco, Sept. 29 to Oct. 2. **P. R. Bradley,** of San Francisco, president of Alaska Juneau Mining Co. and Treadwell Yukon

Corp. and vice president of Atolia Mining Co. and Bunker Hill & Sullivan Mining and Concentrating Co., is general chairman of the arrangements committee of the convention.

James MacNaughton resigned on April 15 from the offices of president and general manager of Calumet & Hecla Consolidated Copper Co. His resignation was due to ill health. His retirement severs a connection with the company begun when he was a boy. He became superintendent of Calumet & Hecla in 1901; general manager and vice president in 1904; and president in 1926. **Albert E. Petermann, Sr.,** who succeeds him as president, has been affiliated with the company for 25 years; for many years with its legal staff and as vice president for several years. **Endicott R. Lovell,** the new general manager, has been with the company since his graduation from Michigan Tech, at Houghton, in 1922. He formerly was superintendent of the smelting plant at Hubbell and several months ago was named superintendent of all the company's properties.

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OBITUARY

Henry Gardner, dean of the metals trade in London, England, died recently at an advanced age.

Albert E. Wiggin, of Great Falls, Mont., manager of Anaconda's reduction department in Montana, died on April 18, 1941.

Edward C. O'Keeffe, 61, head metallurgist in the Coeur d'Alene district for the American Smelting & Refining Co., died on April 5 in Wallace, Idaho.

Otto C. Burkhart, head of the mining engineering department of Virginia Tech since 1908, died at Blacksburg, Va., on April 18, 1941, at the age of 73.

H. Smedley recently accepted the post of mine manager of Sturgeon River Gold Mines, Ltd., a propery near Nezah, Ont. Mr. Smedley had formerly been mill superintendent at the same mine.

John Conibear, 68, well known in mining circles at Ishpeming and Iron River, in Michigan, chief clerk at the Spies-Virgil mine and formerly associated with the Cleveland-Cliffs Iron Company, died at Iron River on April 21, 1941.

George Emerson White, mining engineer, for 30 years vice president and secretary of the Cyprus Mines Corp., died in San Marino, Calif., on March 22. He was 55 years old. Mr. White was an alumnus of the University of California and the Columbia School of Mines and a member of the A.I.M.E. and the Mining and Metallurgical Society of America.

Alexander King, of Coleraine, Minn., general superintendent of the Canisteo district of the Mesabi range for the Oliver Iron Mining Co., died on April 21, 1941, at the age of 57. He was a graduate of the University of Minnesota in mining engineering and took a further course at the Colorado School of Mines. He had been with the Oliver company on the Mesabi range since May 1, 1900.

Marcellus Leonard Nebeker, 71, Intermountain mining engineer, died at his home in Salt Lake City on March 27, 1941. Mr. Nebeker had been superintendent of the Ajax mine, at Eureka, and associated with the development of the Stokes and Stewart interests in Nevada and Idaho.

S. M. Levy, a mining engineer of Berkeley, Calif., died on March 10, 1941, in the 70th year of his age. He was a graduate of Wisconsin University and was prominently identified with the development of many important mining properties of the West. After a period of extensive professional activities, Mr. Levy moved to Berkeley in 1930, to become a consulting engineer. In 1938 he made an extended trip to Honduras, Guatemala, San Salvador, Nicaragua, and Mexico, examining and prospecting mining properties.

Demetrius Edward Alexis Charlton died in Toronto, Canada, on April 28, at the age of 56. "Ted," as he was affectionately known by his many acquaintances, was born in Detroit, Mich., of English parentage. He was a graduate of St. John's Military Academy, at Delafield, Wis., and of the Michigan College of Mines. After a varied experience in practical mining work Charlton became a member of the editorial staff of *Engineering and Mining Journal* in 1917, advancing to the post of managing editor in 1919, in which position he remained until 1922, when he entered the *Journal's* business department. In September, 1925, after having become head of this department, he severed his connection with the *E.&M.J.* Subsequently, with Charles A. Breskin, he organized the Charlton-Breskin Publishing Co., which launched a new magazine, *Modern Packaging,* and various other publications. He remained with the company until 1938, following which year he established himself anew in the publishing business, this time in Toronto. Mr. Charlton was versatile, likeable, and had a considerable reputation as a raconteur, as many readers of this publication will recall. His passing will cause keen regret among a wide circle of friends.

Marcus L. Hurley, who had resided for many years at the New York Athletic Club, died in his sleep on March 27, 1941. His passing was a great shock to his many friends and associates as he was very active and his usual congenial self up to the end.

Mr. Hurley was a well known athlete before and during his college career, having won a number of bicycle races, including an American championship in 1902, as well as a famous race at the Crystal Palace in London. During his college years he was captain of the Columbia University basketball team, as well as a member of its bicycle team. He was captain of the New York Athletic Club's basketball team which won the Metropolitan championship in 1905.

After graduating from Columbia School of Mines in 1908, he went to Montana and began his professional career as a mining engineer in the course of which he operated a number of properties in Montana and Arizona on his own account. He became associated with the late R. E. Cranston in examining mining properties, both vein and alluvial, and in 1924 went to New Zealand, where he acted as manager of gold dredging operations, returning to New York in 1925, which he made his home. Since that time, in addition to his active interest in the New Zealand gold dredging operations, he had been actively identified with South American Gold & Platinum Co. in the development of the dredging operations of that Company in Colombia, South America.

CLINTON BERNARD

JOHN E. ROTHWELL

A Tribute*

John E. Rothwell, mining and mechanical engineer and metallurgist, died at Canoga Park, Calif., Jan. 15, 1941. Rothwell was born in Kingston, Canada, March 20, 1865, his father being Hugh C. Rothwell, a brother of R. P. Rothwell, the latter a former editor of *E.&M.J.* and one of the founders of the A.I.M.E. R. P. Rothwell regarded John as a son, rather than a nephew, and planned his education and course in life.

John was graduated from Queen's University at Kingston and early chose mechanical engineering and metallurgy as his life's work. He designed, built, and operated chlorination and cyanide plants in the Black Hills of South Dakota and in Nevada and had much to do with salt roasting and leaching of silver ores. He was associated professionally with the late Charles M. MacNeill, the late Spencer Penrose, Colonel D. C. Jackling, and Captain J. R. De Lamar. For 27 years he was with the Colorado Iron Works, where he and R. P. Akins invented and developed the impact screen, Portland filter, Akins classifier, Rothwell thickener, and numerous other metallurgical machines. Akins' death preceded that of Rothwell by only a few months.

In 1912 Rothwell severed his association with the Colorado Iron Works to design, build, and operate the Ophir mill, in Butte. That mill was the first to cyanide the silver sulphide ores of Butte successfully. After the Butte cyaniding process was perfected, flotation came into general use and supplanted the cyanide process in treating Butte silver ores.

I conducted the cyanide testing for the Ophir plant and had the privilege of being associated with Mr. Rothwell until the early 1920's. For five years we conducted a metallurgical testing plant in Butte and Rothwell, with the late B. H. Dosenbach, designed, built, and operated the flotation plant of the East Butte Mining Co. He also made many improvements in the copper smelting plant of the East Butte Mining Co. We made the first flotation tests on the chrome ores of south-central Montana, soon to be opened up and brought to production by the United States Government. We invented the airlift thickener and made many improvements on drum filters, as well as carried on research work to recover silver from the heavy zinc sulphide concentrates of the Butte & Superior Mining Co.

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* By Carl J. Trauerman, Butte, Mont.

In all his work Rothwell was careful and painstaking. He never guessed at anything technical. When there was a proved formula for doing something, he used that formula. When there was no proved formula he worked out one and put it to practical use. He was methodical in his work and home life. His principal recreation was reading, mainly technical and economic works. He shunned public mention of his accomplishments.

John Rothwell had a pleasing personality, never became discouraged, rarely lost his temper, and was loved by the men who worked with and for him. In his passing the engineering profession loses one of its brightest lights.

He is survived by his widow, Martha, his daughter and son-in-law, Jeanne R. and Lee R. de Renault, and a granddaughter, Phyllis de Renault. His heritage to the world is "a good job, well done."

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LETTERS

Safety in Philippine Mining

The Editor:

PARACALE GUMAUS Consolidated Mining Co., a Neilson-managed mine, was the winner of the Marsman Safety Shield for 1940. This trophy, donated by J. H. Marsman, is awarded each year to the Class "A" mine in the Paracale district which is a member of the Manbulao-Paracale Mine Safety Association and has the best safety record for the year. Five mines comprise Class "A," defined as a mine having more than 1,000,000 man-hours of labor underground each year. United Paracale Mine was the winner of this trophy for 1939, when Paracale Gumaus finished in second place. United Paracale and San Mauricio tied for second place in 1940.

To determine the winner of the trophy, the frequency and severity of mine accidents are given equal weight. Paracale Gumaus showed a marked improvement in both departments during 1940 compared to its 1939 record. Frequency dropped from 73.92 accidents per million man-hours to 29.55, while severity (days lost per 1,000 man-hours) was reduced from 18.06 to 5.87. There was but one fatal accident in 1940, compared to three accidents during 1939. The reductions in frequency, severity, and fatality rates were 60 percent, 67 percent, and 73 percent respectively, the greatest reduction to be shown by any mine in the district during the year. Compensation cases and costs also showed a great reduction. The number of compensation claims paid dropped from 53 to 22 and the average compensation cost to the company per 100 pesos of payroll was 0.1825 peso in 1940, compared to 0.796 in 1939, a reduction of 77 percent.

While Paracale Gumaus made a great improvement in its safety record, the other mines in the district were not far behind. In fact, it was not until the closing month of the year that the competition was decided. Prior to December there was a four-way tie for the championship, Paracale Gumaus coming out on top, due to its lower frequency rate for the last month. The accident frequency for all mines in the district showed a 45.5 percent reduction for the year.

In Class "B," composed of the six smaller mines in the district, Malaguit Mining, an Elizalde & Co. property, retained the Soriano Trophy, having previously won it in 1939. Only one lost-time accident, of six days' duration, was experienced by the mine during 1940.

Presentation of the trophies will be made at the Third Annual Safety Celebration, to be held later in the year.

P. K. STRONG,
Safety Director,
Manbulao-Paracale District
First Aid and Mine Rescue Association
JOSE PANGANIBAN,
Camarines Nortes,
Luzon, P. I.

Mining Opportunities in Peru

The Editor:

I WAS GLAD to receive your letter regarding cooperation between the Americas, and want to say I am more than willing to do what I can to bring about that state of affairs. I do not know that I have anything of particular interest just now for the general public, but I am as enthusiastic as ever about the possibilities of both quartz and placer mining of gold in this district.

When I took over the Inca Mining & Development Co.'s properties in 1928, I was very much impressed with the possibilities of the Inambari district, and in 1940 undertook to interest United States capital in a large mining concession which I had secured from the Peruvian Government. But due to political conditions here, and financial there, it was not possible to raise any money.

The Santo Domingo mine continued to produce; and since I believe in running mines for profit and using that profit to develop other mines, I have been able to add two more mines to San Domingo. The latter has a 100-ton mill, as also has Montebello, and the Macho mine will soon have a 20-ton pilot mill operating, we hope, within a month. Since no outside capital was used, little or no publicity has been given to the work here.

During 1940 the Peruvian Government set aside the gold tax from our production to be used in the completion of a truck road from Limbani to the Inambari River, about 27 miles, and this road is now being constructed.

We have a great amount of low-grade ore which can be worked at a profit in a large mill, so it is planned to construct a 1,000-ton mill on the Inambari River as soon as the road is completed and machinery can be hauled in. Lack of transportation has prevented the development of the district. Only an occasional prospector ("Gringo") has come in here, but most of them have made good.

There is not a tributary of the Inambari which does not carry gold, and as the river is about 150 miles long there is space enough for several thousand placer miners. The San Juan del Oro mine, at the headwaters of the Inambari, was discovered and worked by the Conquistadores under Pizarro in 1538. Here are gravel banks from which ten to twenty million cubic yards of gravel have been mined. The banks are still from 250 ft. to 450 ft. high and are gold-bearing. All this work was done by primitive methods; and as there are a hundred or more old mines in this vicinity, one can readily come to the conclusion that many thousands of men worked here during colonial times. When the Jesuits were expelled in September, 1775, 8,805 members of this society were driven from the Carabaya district, which is the present Inambari district. As the San Juan del Oro mine is less than 30 miles from Santo Domingo, one can see exploration work has been slow.

I have covered practically all of this district during the 13 years I have been here. In 1931 I made a three months' trip in the lower Inambari with "Swiftwater Bill" Gates, of Alaska fame, and we found placers that could be worked by pick and shovel. The Chaspis and other mining camps soon started up. Gates stayed in the lower country, and at the time of his death had a good mine on the Marcopata River, a tributary of the Inambari.

There are plenty of prospects which may become mines and a large part of the district is unexplored. So with modern transportation this should become one of the important gold producing sections of the world. Mining can be carried on throughout the year, but transportation is difficult, as there are no roads and few trails.

We have a healthful climate, practically perpetual spring, with a minimum temperature of 59 deg. and a maximum of 85 deg. F., and about 25 in. rainfall per year. Water power is abundant, and by installing water wheels for high head of the Pelton type, mills suitable for treating gold can be erected at a reasonable cost.

What we need here more than anything else is men of the type who operated mines in the Western United States from 1890 to 1900—men who could go into the most isolated places, erect a sawmill, and soon have a complete mill and gold mine in operation and making money. There is no limit to what that type of man could do in this undeveloped country. But the man who must have modern milling equipment before he can operate need not come here, as there are only mule trails now and mules are small, packing only about 200 lb., while anything in excess must be packed by men, and those packers are hard to get. There should still be such men of the pioneer type in the United States. They should come down here while the price of gold is still high, enrich themselves, and develop the country at the same time.

There is rich agricultural land on the east slope of the Andes adjacent to these mining areas, and with transportation it should not be long until this country will rival the Sacramento Valley of California as a desirable place for mining men to live and work. Trucks, airplanes, radio, plus the right kind of men, will open up this section of America much more quickly than did our ancestors, the 'Forty-niners.

CLARENCE WOODS,
President,
Inca Mining & Development Company
Tirapata, Peru

NEW BOOKS

DESCRIPTIVE GEOMETRY. *A. S. Levens and H. C. T. Eggers. Published by Harper & Brothers, New York, N. Y. Pp. 240. Price $2.50.*

TRADITIONALLY, teachers of descriptive geometry have dealt with surfaces, lines, and points (and their intersections and projections) by graphical methods alone, although it has long been known that each such problem has its corresponding algebraic solution. Levens and Eggers have modernized and vitalized descriptive geometry by adding algebraic solutions to the graphical. Thus the student who masters this book will be equipped with two complementary tools for every task of engineering drawing and mapping. He can select the one best suited to the particular job, or use one to check the other.

The book may be recommended to the practicing engineer, as well as to the college student, because (1) it will modernize his understanding of the "descript" he once studied by the traditional method; (2) it will increase his ability to handle unusual problems in mapping and engineering drawing; (3) it devotes a whole chapter to practical engineering applications. These include shadows, perspective, developments, vectors (as applied to framed structures), and mining problems (relating to veins, shafts, faults, outcrops, etc.).

THE MINING YEAR BOOK, 1941. *Walter E. Skinner, 15 Dowgate Hill, Cannon St., London, E.C.4. Pp. 860. Price 20s. net; 21s. 6d. post-free abroad.*

IN THE 59th annual issue of this work one will find full particulars of the world's principal mining companies brought up to date despite unusual difficulties arising from the war. Nearly 1,000 companies are listed in alphabetical order, together with 2,965 directors of mining companies and 1,035 mining engineers and mine managers. In no other single work published in any country can anything approaching such complete details be obtained on mines operating in every part of the world.

NON-FERROUS PRODUCTION METALLURGY. *John L. Bray. John Wiley & Sons, Inc., New York. Chapman & Hall, Ltd., London. Pp. 430. Price $4.*

DESIGNED as a text for instruction in the production of nonferrous metals. Prof. Bray's book will be a welcome addition to the general metallurgical library. During the past year, particularly, mining engineers and metallurgists have had their attention directed to many uncommon ores and metals and have needed a ready reference to the technology of production. In the present work the reader will find brief but adequate background for the metallurgy of ores of such metals as antimony, chromium, manganese, magnesium, molybdenum, and others—23 in all. In addition to the technical aspects of production, each chapter contains economic and market information. The plan and execution of the volume are such as to afford fundamental information in condensed form.

SILICOSIS—PROCEEDINGS OF THE INTERNATIONAL CONFERENCE HELD IN GENEVA FROM AUGUST 29 TO SEPTEMBER 9, 1938. *Published by International Labour Office, Geneva, Switzerland. Available in United States from Washington Branch, International Labor Office, 734 Jackson Place, Washington, D. C. Pp. 223. Price $1.25 (paper cover).*

THIS is essentially a report of the proceedings of the conference at Geneva in 1938. However, it is supplemented by 14 appendixes which give special technical interpretation of various biochemical, pathological, and engineering features of the problem. Taken altogether, these appendixes are an excellent composite reference to present knowledge as interpreted by experts of international standing.

SALES ENGINEERING. *By Bernard Lester. John Wiley & Sons, Inc., New York. Chapman & Hall, Ltd., London. Pp. 200. Price $2.*

IN THE industrial economy that has developed to such a high degree in the United States, a new art has been born that offers employment for engineers. We refer to sales engineering, the selling of technical products to industry. Mr. Lester's volume is written for young technical graduates and is designed to answer such questions as "What is sales engineering?" "What possibilities does it offer?" "What are the qualifications for success in this work?"

Divided into three parts, the book outlines the field of sales engineering, the work of the sales engineer in selling, and the training and development of the sales engineer.

Among the industries offering opportunities for sales engineers, mining holds a prominent position. Mining and metallurgical equipment is best sold by trained engineers who have had some experience in the field and who know how to approach their fellow engineers who are in the market for machinery. Graduates of mining schools who think they are qualified for technical selling will get a much clearer picture of the field and of their own capabilities by reading this excellent vocational monograph.

TECHNICAL DRAFTING. *By Charles E. Schumann. Harper & Brothers, New York & London. Pp. 793. Figs. 857. Price $3.50.*

DESIGNED not only as a comprehensive textbook on engineering drafting but also as a professional reference book for engineers, this work has a distinct industrial flavor and shows that "many of America's largest industrial corporations and leading engineers have contributed to its preparation." Part I deals with the elements of engineering drafting, the treatment of which leads logically to Part II, professional drafting. Separate chapters of the latter are devoted to different branches of engineering, one of them dealing with problems met particularly in mining engineering. The book is written in readable style and is profusely illustrated. An appendix contains tables useful to the draftsman.

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PUBLICATIONS

RECEIVED

Transvaal Chamber of Mines, Fiftieth annual report, for the year 1939. Also report for 1939 on work of Timber Research Laboratory. Johannesburg, Transvaal, S. A.

Arizona. 1940 Annual Report of State Mine Inspector. Published at Phoenix, Ariz. Pp. 24.

Lake Superior Iron Ore. Report on mine shipments, in 1940, in gross tons, railroad weights. Lake Superior Iron Ore Association, 1170 Hanna Bldg., Cleveland. Pp. 6.

Natural Sandstone Rock Asphalt. Report of an investigation by O. R. Tyler, W. H. Goetz, and C. Slesser. Research Series No. 78, Engineering Experiment Station, Purdue University, Lafayette, Ind. Pp. 76.

Some New Mexico Fusilinidae. By C. E. Needham. Bulletin No. 14. New Mexico State Bureau of Mines and Mineral Resources, Socorro, N. M. Pp. 88.

U. S. Geological Survey has issued the following (for sale by Superintendent of Documents, Washington, D. C., at stated price): Bulletin 922-H, "Tungsten Deposits of Atolla District, San Bernardino and Kern Counties, California," pp. 205-245 with maps, price 25c. Also Bulletin 922-I, "Antimony Deposits of Part of Yellow Pine District, Valley County, Idaho," pp. 247-279, plus maps, price 30c. Also Bulletin 922-J, "Chromite Deposits in Seiad Quadrangle, Siskiyou County, Calif.," pp. 281-306, plus maps, price 30c. Also Bulletin 922-K, "Antimony of Wildrose Canyon Area, Inyo County, California," pp. 307-325, plus maps, price 25c. Also Bulletin 922-M, "Tin Deposits of Black Range, Catron and Sierra Counties, New Mexico," pp. 355-370, plus maps, price 50c. Also Bulletin 922-O, "Chromite Deposits of Pilliken Area, Eldorado County, California," pp. 417-460, plus maps, price 35c. Also Bulletin 922-P, "Chromite Deposits in Sourdough Area, Curry County, and Briggs Creek Area, Josephine County, Oregon," pp. 461-496, plus maps, price 30c.

Geology of St. John Region, New Brunswick. Dominion Geological Survey, Ottawa, Canada, pp. 65, plus maps, price 25c.

Investigations in Ore Dressing and Metallurgy. January-June, 1939. Dominion Bureau of Mines, Ottawa, Canada, pp. 195, price 50c.

U. S. Bureau of Mines, Washington, D. C., has issued the following Information Circulars and Reports of Investigations (no charge is made):

Information Circular 7144, "Some Information on Quarry Safety," pp. 23. Also I. C. 7145, "Mining and Beneficiation of Appalachian Manganese Ores," by Edmund Newton, pp. 46.

Report of Investigations 3542, "House Movement Induced by Mechanical Agitation and Quarry Blasting" Progress Report No. 3, pp. 36. Also R. I. 3555, "Use of Subaudible Noises for Prediction of Rock Bursts," pp. 4.

What Metal Statistics Show

PRODUCERS had the price situation clarified on copper in a recent statement by Leon Henderson (see page 74) that a mandatory ceiling would not be imposed at this time.

Several zinc mines in the Tri-State area were flooded late in April by heavy rains and observers are doubtful if production will be maintained at the same rate as earlier in the year.

The duty-free copper statistics of March showed a reduction in stocks of refined of 7,816 tons. Blister stocks were down 9,679 tons. The February and March figures of the Copper Institute, in tons, follow:

	Feb.	March
Production:		
Crude	(a) 79,240	85,643
Refined	93,654	95,322
Deliveries, refined:		
Domestic	112,808	(b)134,333
Export	11	6
Totals	112,819	134,339
Stocks, refined	97,689	89,873

(a) Corrected. (b) Beginning March, 1941, includes deliveries of duty-paid foreign copper for domestic consumption.

Until Louis S. Cates, president of Phelps Dodge, informed stockholders that under the Revenue Act of 1940 the import tax of 4c. a pound on copper had been extended until June 30, 1945, few in the industry knew that this change had actually occurred. The Act states in a brief paragraph headed "Continuation of Excise Tax" that the measure of 1939 has been amended by "striking out '1941' wherever appearing therein and inserting in lieu thereof '1945.'" The items affected were not mentioned.

▶QUICKSILVER — Consumption of quicksilver in the United States during February was 4,700 flasks, which compares with 2,900 flasks in January, according to the Bureau of Mines, Department of the Interior. Consumption in the first two months of 1941 was well above the monthly average for 1940 and the gain resulted chiefly from increased absorption of the metal in the manufacture of mercuric oxide.

Domestic production of quicksilver amounted to 2,900 flasks in February, a decline from 3,100 flasks for the preceding month. After allowance is made for the shorter working period, a small increase is indicated in the daily rate for February. Heavy rains in California were reported to have interfered with production in the first two months.

The statistics for eight months beginning with July, 1940, in flasks of 76 pounds, follow:

1940	Production	Consumption	Exports
July	3,200	2,200	1,031
August	3,500	2,100	633
September	3,600	2,100	799
October	3,600	2,700	757
November	3,400	2,900	361
December	3,700	2,100	566
1941			
January	3,100	2,900	455
February	2,900	4,700	347

▶LEAD—Consumption of lead continues at a high rate, estimated between 62,000 and 65,000 tons monthly. An unexpected strike was called at the Parral lead-zinc unit of the American Smelting & Refining Co. on April 28.

Imports of lead during March were large. Lead content of ore and matte imported in that month totaled 9,805 tons, with bullion accounting for 5,253 tons, and pig lead 15,892 tons.

Statistics covering lead refined in this country for the months of February and March, in tons, according to the American Bureau of Metal Statistics, follow:

	Feb.	March
Stock at beginning	47,248	46,604
Production:		
From domestic ore	47,764	46,748
Secondary and foreign	6,467	14,755
Totals	54,231	61,503
Domestic shipments	54,859	62,090
Stock at end	46,694	45,996

▶ZINC—The zinc pool from which the Priorities Division of the Office of Production Management may make mandatory allocations to meet urgent defense needs has been raised from 5 percent of production to 17 percent for the month of May, according to an announcement by E. R. Stettinius, Jr., Director of Priorities, on April 18.

A summary of the figures of the Prime Western division for the first four months of 1941, in tons, follows:

	Production	Shipments	Stock At End
January	(b)26,620	28,209	(b)4,694
February	(b)24,814	26,581	(b)2,927
March	(b)29,101	28,907	(b)3,121
April	28,510	28,502	3,129

(b) Corrected.

For the month of April, producers of slab zinc were required to set aside an amount of the metal equal to 5 percent of January production. For May, the 17 percent pool will be based on March production and should amount to approximately 12,000 tons.

Decision to increase the size of the pool was made by the Minerals and Metals Group of the Priorities Division after a review of the present situation in the zinc industry.

The domestic statistics for March and April, according to the American Zinc Institute, in tons, follow:

	March	April
Stock at beginning	(b) 7,165	7,072
Production	(b)63,390	63,305
Production, daily rate	2,044	2,110
Shipments (a)	63,483	63,066
Unfilled orders	97,638	95,256
Stock at end	(b) 7,072	7,311

(a) There were no exports of domestic slab zinc during the months of February, March and April. (b) Corrected.

E & M J Weighted Index of Non-Ferrous Metal Prices

(100 is composite for 1922–3–4)

1929	110.33	1935	74.66
1930	82.87	1936	73.45
1931	60.20	1937	90.86
1932	48.26	1938	73.67
1933	59.79	1939	77.71
1934	69.59	1940	79.22

	1939	1940	1941
January	77.12	80.85	82.48
February	76.89	77.23	82.76
March	77.09	77.94	(a)83.27
April	74.79	77.19	83.48
May	73.61	77.68	....
June	73.17	78.85	....
July	71.95	76.72	....
August	73.88	76.71	....
September	83.07	79.40	....
October	84.25	82.49	....
November	83.89	83.14	....
December	82.89	82.42	....

(a) Corrected.

Zinc Output From Domestic Mines

DESPITE the urgent demand for zinc for national defense purposes, domestic mine output is expanding only at a slow rate, according to the Bureau of Mines, United States Department of the Interior. The Bureau reported that only a moderate increase was anticipated later in the year when a few mines that have been idle for several years will be brought into production. Because of the importance of zinc to national defense industries, the Bureau of Mines has inaugurated monthly surveys of mine output, of which this is the first. Details for the three months covered are as follows:

Mine production of zinc in December 1940 and January and February 1941, by regions and States, in terms of zinc recovered in form of slab zinc, pigments, and salts, in short tons

Region	December 1940	January 1941	February 1941	3 mo. total
Eastern States	16,233	15,800	14,592	46,625
Central States	18,820	21,898	20,058	60,776
Western States:				
Arizona	1,597	1,714	1,497	4,808
Colorado	437	353	256	1,046
Idaho-Nevada-Utah	10,312	11,134	10,452	31,898
Montana	4,276	4,105	3,838	12,219
New Mexico	3,263	3,371	2,691	9,325
Washington	992	1,309	1,199	3,500
	20,877	21,986	19,933	62,796
	55,930	59,684	54,583	170,197

New steel headframe at the Patten shaft near Amador City, Amador County, Calif., operated by the Keystone Mine Syndicate. Gold ore is mined on four levels, including the 2,100, and trucked to the Original Amador mill near by

CALIFORNIA

Hydraulic Mining Increases Behind New Debris Dam

Operations gradually being stepped up following completion of Upper Narrows dam near Smartville—Argonaut Mining Co. begins operation of new cyanide plant

▶ Hydraulic mining operations are steadily increasing behind the new Upper Narrows debris dam near Smartville, Yuba County. Two hydraulic monitors are working at the Relief Hill mine of Western Gold, Inc., near North Bloomfield, Nevada County, where 20 men are employed under the direction of C. E. Clark, superintendent, and full-scale hydraulic operations are under way at the Omega property, near Washington, Nevada County, with three monitors active. Theodore A. Larsen is superintendent at the Omega mine, and about 22 men are employed. The Federal Power Commission has granted a license for construction of a 13,500-hp. hydro-electric plant at the site of the Upper Narrows debris dam to the Sacramento Valley Utility Co. Payment of $1,500,000 on the part of the utility company as specified in the contract will be deducted from the cost of construction of the dam.

▶ Argonaut Mining Co., Ltd., has placed in operation the new cyanide concentrate treatment plant completed recently at its property near Jackson, Amador County. The plant will also handle concentrates produced at the Plymouth tailings plant besides those from the Argonaut mill. Alex. F. Ross, general superintendent, directs operations.

▶ Henery Dredging Co. is removing its dragline dredging equipment from the present dredging site along the north fork of the Calaveras River to placer ground near Hornitos, Mariposa County.

▶ Junction City Mining Co., H. L. Sorenson, president, has acquired 90 acres of placer ground in the Minersville area of Trinity County from Goldfield Consolidated Mines Co., of Nevada. The property is adjacent to other holdings of the company extending along the upper reaches of the Trinity River, where the company operated the Madrone dredge for years.

▶ Golden Feather Dredging Co., headed by E. A. Wiltsee, of San Francisco, is reported to have signed a contract with the city of Oroville for dredging the south bank of the Feather River at Oroville. The large dragline dredging unit of the company is now working the north bank of the river.

▶ Development work is proceeding at the Davidson mine, near El Dorado, El Dorado County, recently acquired by the Alto evelopment Co., B. J. McManus, president. The property was operated by a French company from 1911 to 1914 and is credited with a fair production of gold ore. Early construction of a mill is planned.

▶ Two hydraulic monitors are in operation at the Davis mine, near Happy Camp, Siskiyou County, where hydraulic mining was resumed recently by the Curley Jack Mining Corp., controlled by Seattle, Wash., interests.

▶ E. L. Cord, of Beverly Hills, has acquired the properties of Darwin Consolidated Tungsten Corp. headed by C. W. Fletcher, of Bishop, Inyo County. The mine is situated near Darwin, and has been under development for several months. A number of shipments of tungsten ore have been made by the Fletcher interests.

ARIZONA

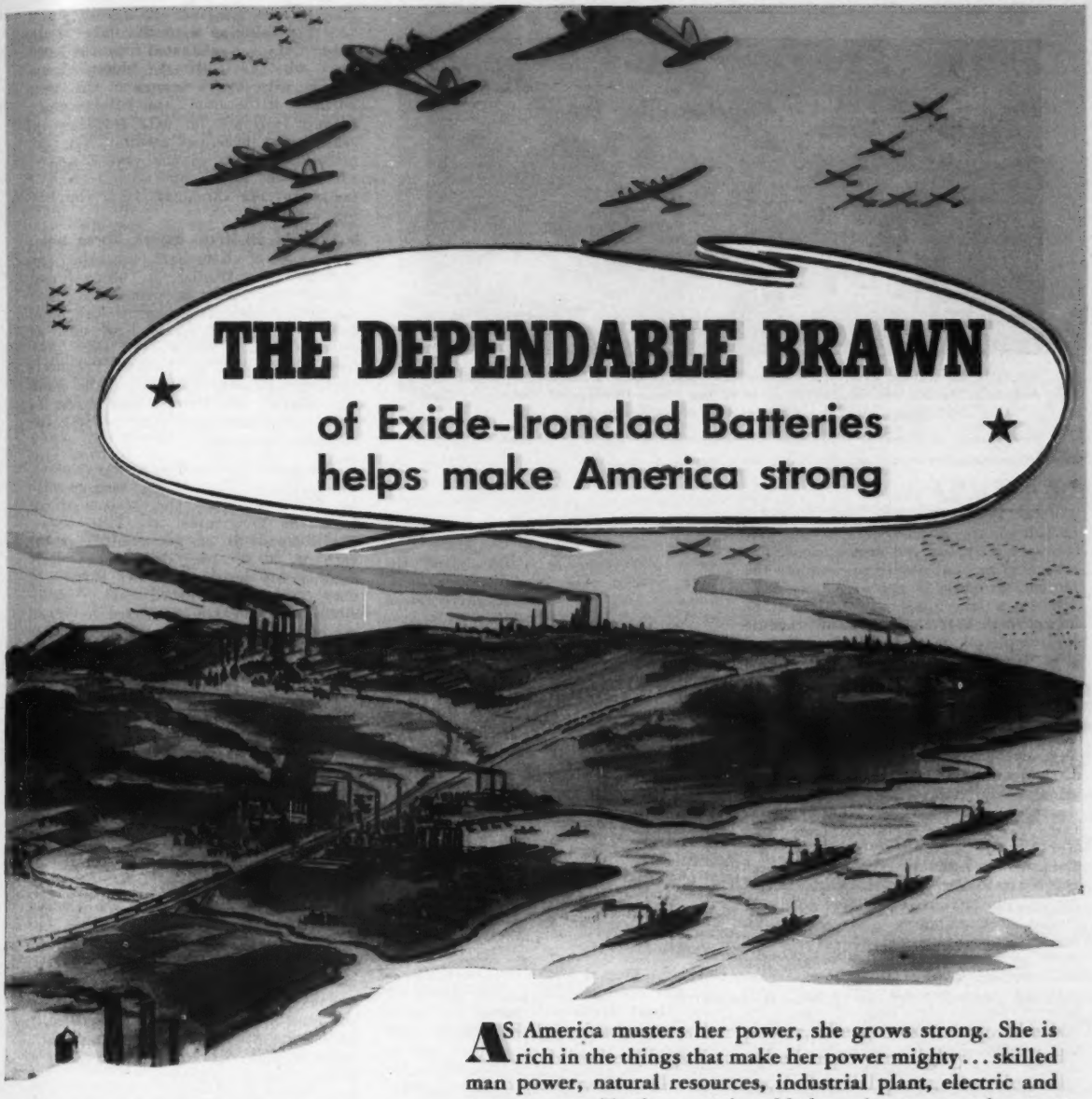
Copper From New Morenci Unit Expected This Year

Annual report of Louis Cates, president of Phelps Dodge Corporation, indicates 1941 expenditures for completion of enterprise will total $21,700,000

▶ Mining operations, in 1940 of the Phelps Dodge Corp. reported by Louis S. Cates, president, stated that the Copper Queen branch, at Bisbee and Douglas, the New Cornelia branch, at Ajo, and the United Verde branch, at Jerome and Clarkdale, furnished the major part of the year's production of copper, gold, and silver, the remainder coming from the Morenci branch, at Morenci, and the Montezuma Copper Co. property in Sonora, Mexico. Copper-production schedules were increased sharply during the last part of the year. The San Carlos property, in Chihuahua, Mexico, operated for eight months and produced lead-silver concentrates. The Bisbee mines of the Copper Queen branch produced 804,926 tons of ore from the Limestone Division. In comparison with 1939, a larger tonnage of ore was mined, the copper content of the ores mined was lower, and there was a slight increase in copper production.

▶ During the year, work on the Morenci project continued steadily and according to schedule. Barring delays in the delivery of materials and equipment which might arise from priorities issued under the national defense program, or from unforeseen causes, it is expected that the development of the open-pit mine and the construction of the new reduction works will be completed and production started by the end of 1941. Capital expenditures at Morenci in 1940 amounted to $5,669,726.52. From 1937, when the work started, through 1940, capital expenditures at Morenci have amounted to $13,107,065.63. Included

Mill and cyanide plant of the Central Eureka Mining Co., at Sutters Creek, Amador County, Calif. The plant treats about 5,000 tons of gold ore per month



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Above is the surface plant of Callahan Zinc Lead Co. at its Duquesne property, in Arizona. The 125-ton flotation plant is in the lower foreground; Duquesne shaft and storage bins at top center and diesel power plant at right

▶ARIZONA

in this figure is $5,806,777.19 for preliminary stripping and development. The estimated amount needed to complete the Morenci program is approximately $21,700,000, a large part of which will be expended in 1941 if the present schedule for completion is carried out.

▶At this unit the work of stripping the overburden in the open-pit mine proceeded on schedule. A total of 12,349,165 tons was removed, compared with 8,868,278 tons in 1939. The total tonnage stripped to date, commencing with 1937, amounts to 28,916,706 tons. There remain approximately 17,500,000 tons of waste to be moved before mining operations commence. Stripping operations were largely in the Clay Mountain, the Colorado, and the Liverpool areas. Five benches are now serviced by rail. New pit equipment purchased in 1940 included electric shovels, diesel-electric locomotives, and 30- and 40-cu.yd. dump cars. A locomotive and car repair shop and an oil storage house were constructed near the pit. The test mill treated 546,173 dry tons of ore. All major equipment tests were completed and the flowsheet for the new mill was decided upon in September. The reduction works is designed to treat about 25,000 tons of ore per day.

▶A new water reservoir for the reduction works site is being constructed in Morenci, and work is proceeding on a tunnel through which the new pipe line between Eagle Creek and Morenci will pass for part of its length. Seventy-four additional housing units were completed. Natural gas was brought into the reduction works area late in the year.

▶The Douglas smelter operated continuously throughout 1940 and smelted a total of 1,222,808 tons of ores, concentrates, precipitates, and custom ores. Operations varied from a two-furnace to a four-furnace basis. Towards the end of the year, work was started on a new furnace and high-pressure boilers to replace one of the old furnaces. The main crane aisle of the converter department was extended and a new Peirce-Smith converter installed. Greatly improved smoke conditions and reduction in dust losses in this department have resulted from the erection during the year of a 565-ft. concrete stack and the installation of a Multi-cone dust collecting system.

▶New Cornelia branch operations were on a continuous basis throughout the year, broken only by a summer shutdown of two weeks. There were mined at the open pit 6,438,740 tons of ore and 6,491,333 tons of waste, of which 1,082,120 tons came from Arkansas Mountain stripping operations. The waste ratio was 1.01, of which 0.84 was in the pit proper. All loading was done by full-revolving electric shovels. The diesel-electric locomotives were taken out of service in July and transferred to Morenci. Twenty 30-cu.yd. cars were purchased during the year. The concentrator treated 6,443,980 tons of ore. Metallurgy remained about constant, but there was an improvement in costs due largely to improved ore breakage in the mine and to the adoption of single-stage grinding in the mill. Mechanical department, power plant, and pumping operations were largely routine.

▶At the United Verde branch, the open pit was completed as an ore producing unit about April 1, bringing to a close the pit mining program started in 1918. Hereafter operations in the pit will be confined to quarrying waste filling for the underground stopes. Development footage amounted to 27,679 ft., most of which was diamond drilling. This total also includes 235 ft. of shaft sinking and 235 ft. of sinking with the Calyx drill. Shaft sinking was started from the 3,000 level with the ultimate object of exploring with level development the lower horizons of the mine. One reverberatory furnace equipped for bath smelting operated with excellent results. For the last two months of the year a second furnace was put in operation to handle temporary ore shipments from the Bisbee mines.

▶The old Bi-Metal mines, three miles southwest of Kingman, controlled by the Geronimo Mining Co., has resumed operations. Under present development the property shipped many thousands of tons of ore to the Tom Reed mill, at Oatman. It is understood that shipments will now go to the Producers custom mill near Chloride. The hauling contract has already been made for the transportation of the ore. Leslie Saunders is manager.

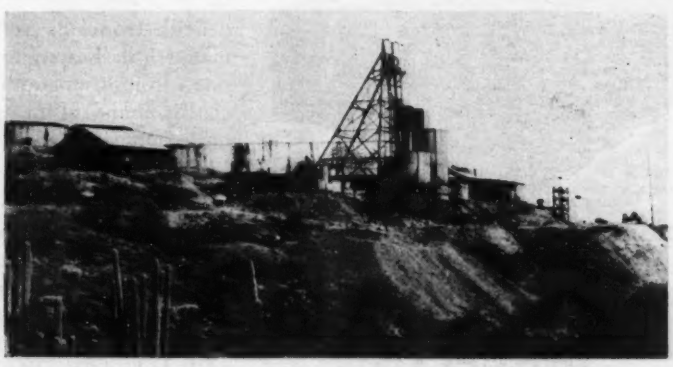
▶The Gold Standard company, operating at the old Katherine mines, is milling 250 tons daily. The ore is produced from the Tyro mine, five miles away. The company is also stockpiling at the rate of 50 to 100 tons of ore daily against any future shutdown because of shortage of ore which weather conditions might hazard. Richard de Smet, mailing address at Kingman, is general manager of the company.

▶J. A. Potter, in control of the Golden Door mines, in the Chloride district, has leased the property and it is now shipping ore to the Producers mill, at Chloride. The Golden Door mine is the property of Keene St. Charles, former State Senator and a resident of Kingman.

▶Continental Mining Co., operating the Ed. Williams tungsten properties in the Francis Creek area of the Aquarius Mountains in Mohave County, has resumed milling operations after a short closedown for mill changes. The mill is now running 25 tons daily on an 8-hr. shift. F. A. Koffman, of New York City, is manager.

▶The Telluride mine, at Oatman, is shipping ores both to the Vivian mill, near Oatman, and to the Producers' mill, near Chloride. T. S. Hodges, of Oatman, is owner of the property.

▶A quicksilver property 12 miles east of Tonto Basin is being operated by the



Headframe and part of surface plant of the Mammoth-St. Anthony, Ltd., property at Tiger, Ariz.

End Line Quick Syndicate, of Redlands, Calif. The operators plan to install a furnace and other equipment. Albert Judd, of Redlands, is in charge of operations.

▶P. L. Mullen and associates, who have been operating the Philadelphia property, in the Katherine district, and shipping ore to both the Gold Standard and the Producers' mills, may build a cyanide plant on the property to treat their own ores. Recent development has affirmed the expectation that commercial ores will be found in the property.

▶Davenport Mining & Reduction Co. announces that it will start operations in the Torch Tunnel of the Oro Plata mine, in Todd Basin, 12 miles north of Kingman, in the Cerbat range. The mill, which was recently put in order by the Gold Cliff Central Mining Co., is situated near the portal of the tunnel which taps the Oro Plata property, and will be used in the treatment of the ores. O. C. Chase, of Las Vegas, Nev., is president and general manager of the Davenport company.

▶The Emerald Isle Copper Co. continues to make improvements on its property near the mouth of the Mineral Park Canyon. The pipe line has been completed, water is delivered to the camp, and plans are being made for the installation of a large leaching plant to recover the copper. Cyrus F. Weeks is engineer in charge.

▶Contractors are hauling 2,500 tons of manganese from the Atillery Peak country, in southern Mohave County, to the U. S. laboratory at Boulder City, Nev., where treatment methods will be experimented. The U. S. Bureau of Mines is in charge of the work at the mines under the personal direction of Robert S. Sanford, mining engineer of the Bureau. The M. A. Hanna property, in the same district, is reported to be planning the installation of a small pilot mill for mechanical concentration of manganese ores. The Hanna company headquarters are in Cleveland, Ohio.

▶The Boriana tungsten mine, 25 miles east of Yucca, in Mohave County, and operated by the Molybdenum Corporation of America, is running about 1,200 tons monthly. The mine is running on two shifts and the mill is operating one shift per day. The payroll carries 120 men. H. L. Veatch is in charge. His address is Yucca.

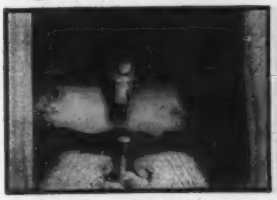
▶Riveria Brothers and Lambert Wood, of Oracle, are enlarging their tungsten mill near Camp Bonito, 6 miles from Oracle. The ores come from Morning Star and the Southern Belle groups of claims.

▶The Bagdad Copper Corp., operating near Hillside, Ariz., treated 73,600 tons of ore in 1940, which yielded approximately 1,540,000 lb. of copper. The property has been working at capacity during the year. J. W. Sill is in charge of operations.

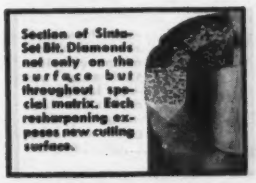
▶Forty tons of quicksilver ore are being treated daily in the Gould rotary furnace at the Pine Mountain cinnabar mines in the Sunflower district in the Mazatzal Mountains south of Payson. Samuel Joseph of Mesa, Ariz., is general manager.

HERE'S a typical example of the results being obtained with Carboloy Sinta-Set Core Bits—as reported by a large midwestern mine:

179 feet of hard gold-bearing quartzitic formation drilled to date with an EX Sinta-Set diamond core bit. Just two resharpenings needed. Total wear only .006" on inside diameter, .018" on outside diameter and .058" in length. *Estimated total life—700 feet!*



A 5-minute sandblast operation resharpens Sinta-Set Bits. Compact, economical equipment available. See catalog No. M-100.



Section of Sinta-Set Bit. Diamonds set only on the surface but throughout special matrix. Each resharpening exposes new cutting surfaces.

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. . . and you eliminate all reprocessing, resetting, and lost diamonds. The diamonds are permanently embedded in a special Carboloy tungsten carbide matrix—not only on the surface but throughout the entire matrix. This provides a series of new cutting surfaces available for your use during an unusually long period of life, and you get almost complete diamond utilization.

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It Happened in Sixty-Six

Engineering and Mining Journal was established 75 years ago last month as the American Journal of Mining. Our anniversary will not be celebrated, however, until next August, when we shall publish a Diamond Jubilee issue of E.&M.J. In the meantime, we shall reprint each month a few selected items from Journals of 75 years ago. The following are culled from the issues for May 1866.

California Platinum

A white metal has often been found in some of the California *placere* diggings, which is now ascertained to be platinum. It is worth, in California, $6 per oz., unless when largely mixed with iridium or osmium, as is often the case, when it brings but $2 per oz. This white metal is used in tipping gold pens with what are termed "diamond" points, for which purpose 400 ounces of it are annually exported from San Francisco.

A Question Answered

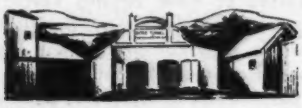
The *Artisan*, in the course of a brief article on nitro-glycerine explosions, asks:

> * * * whether the glycerine and nitric acid, of which it is made can be properly mixed where they are to be used?

Without doubt, they can be so mixed. But there are other considerations involved by such a course. Nitric acid is nearly as dangerous to carry and is three times the bulk of nitro-glycerine; but then the residum can be made useful.

The Great Comstock Drain

The California steamer brings us the news this week, that the mining companies of the Comstock lode have at last decided to enter into a contract with the Sutro Tunnel Company for the draining of their mines; or, rather, that the



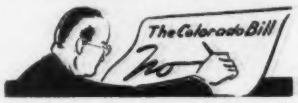
Gould & Curry, Crown Point Imperial and Savage Companies, have resolved to so contract, and that the other companies had called meetings for a similar purpose—which is about the same thing. In other journals we have long urged the construction of great drain-adits . . . but we feared the procrastinating spirit of our mining companies, and particularly those of the Comstock lode, which until recently, have been too jealous of one another to think of working in concert. But, "better late than never." The thing is arranged.

New Quartz Crusher

In Melbourne, Australia, a quartz-crushing machine, capable of working up 300 tons a week, has been constructed, which crushes and amalgamates at one operation. It is expected to do the work at a cost of one shilling and seven pence (about thirty-eight cents in coin) per ton, while the cost in a machine working 2,000 tons per week is calculated at six pence (twelve cents in coin) per ton. The bed of clay beneath Philadelphia, which contains about thirty-eight cents' worth of gold per ton, could be worked at these rates.

The Colorado Veto

The President has vetoed the Colorado bill. The reasons he gives are that statistics received after the bill was under discussion show the population of the State to be so small as to render representation in the Senate inexpedient;



that this population is actually decreasing; that it would greatly increase the expenses of the Territory if a State Government were introduced; and that it is uncertain whether the people themselves desire a State Government. It remains to be seen whether Congress will over-ride the veto, in this as in other cases.

Assays of Nevada Ores

The School of Mines of Columbia College, with a view to aid in diffusing correct information in regard to the mineral wealth of the Pacific States, has undertaken to make gratuitous assays of ores sent from those States for that purpose, on the following conditions:

1. The specimens sent must be in masses weighing not less than five pounds each. This is in order that some judgment may be formed of the general character of the ore, and the results approximate more nearly to a working assay.

2. The specimens must be accompanied by affidavit, or other satisfactory form of proof, that they have been actually taken from the veins or lodes, from which they are said to have been obtained.

Mining Machinery

The report of the meeting of the Miners' Association, of Devon and Cornwall, England, which we have been looking over, shows the obvious advantages which the modern appliances of machinery afford to miners. In England a prejudice exists among the miners themselves, against boring machines and new mechanical appliances generally. Capitalists, however, are beginning to find out the great savings which may be effected by machinery. It was stated at the meeting, and it is undoubtedly true, that no business conducted with so much waste of time and money, as mining there is conducted, could possibly pay. Here these prejudices against new inventions do not exist, and all miners would glady use new appliances if they could make sure of the merits of the respective machines. We shall be glad to forward the interests of miners by publishing the results of actual working trials of machinery likely to be useful in mining operations.

COLORADO

Ajax Mine Being Rehabilitated

Work progressing rapidly at first property to be unwatered through the Carlton Tunnel—Other producers in Cripple Creek area prepare for deeper operations

▶ The Ajax mine, now free of water drained off through the new Carlton tunnel, has completed the general clean-up, installed new 3,700-ft. cables, and is ready for extensive development work. About nineteen groups of leesses are working at the property. The compressors at the mine are again in operation, supplanting the air furnished from the Portland during the past two years. A main station has been cut on the 2,400-ft. level, so that ores can be handled from the old stope on the New Market vein. Work in pulling the broken ore from the New Market stope on the 2,300-ft. level is in progress. Mr. Carlton, superintendent, states that several machines will be put to work on the old New Market stope on 2,400 level and also drifting south of this vein.

▶ The Carlton drainage tunnel, in the Cripple Creek district, is now nearing the Portland No. 2 shaft. A recent flow of 20,000 g.p.m. was struck in the tunnel as the face hit the southern contact. Due to the continued heavy flow of water, the heading of the Carlton tunnell was detoured around the fault from which the water came. The heading is being driven ahead toward the Portland No. 2 shaft. From this point the United Gold Mines will continue driving some 3,500 ft. to the Vindicator shaft, one of its Bull Hill properties. Another lateral will be driven to the Cresson shaft, a distance of 4,000 ft. Cresson lessees have been shipping more bonanza gold ore recently, indicating that this property may have new bonanza oreshoots in deeper workings.

▶ The Poorman mine, owned by J. G. Clark and E. F. Green, of Boulder and Tungsten, respectively, made an excellent record in 1940. The gross production from the property totaled $159,598, with a tonnage of 73,118 that had an average value of $21.80 per ton. Dan Schnell is mining ore from the Poorman vein on the 475 level, and made one shipment of ore that assayed 53.685 oz. gold and 28.83 oz. of silver.

▶ George Rowe is supervising the work of pumping out the Old Smuggler mine, in the Silver Plume area.

▶ The old Blaine mine, on the north side of Mt. Sneffels, not far from the Camp Bird and Atlas mines, is to be reopened by Mr. Sherbino and A. V. de Pascale, of San Antonio, Tex.

▶ The Chamber of Commerce mining and

CORNISH STAMP MILL OF THE 16th CENTURY — USED IN CALIFORNIA 19th CENTURY

HISTORY records the use of a mechanical device for crushing ores to powder fineness. This device became known as the stamp mill. Greatly improved, it is still an important factor in beneficiation processes.

The process of flotation, however, is considered an equally, if not a more important, advance in this field. It is the high spot in the furtherance of the non-ferrous mining industry.

Great Western is considered the leader in this field. In conjunction with the modern flotation cell, the BEAR BRAND line of *seven* Xanthates, is credited with having contributed more to the profitable recovery of low grade ores than any other single factor.

Because of a constant program of flotation research further important contributions will undoubtedly be identified with Great Western.

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Note: The new edition of the BEAR BRAND Flotation Index, which lists books, pamphlets and articles on flotation, is ready. Write for your free copy.

BEAR BRAND XANTHATES

3 Z3—Potassium Ethyl Xanthate

4 Z4—Sodium Ethyl Xanthate

5 Z5*—Potassium Amyl Xanthate

6 Z6*—Potassium Pentasol Amyl Xanthate

8 Z8—Potassium Secondary Butyl Xanthate

9 Z9—Potassium Isopropyl Xanthate

10 Z10—Potassium Hexyl Xanthate

**From Sharples Amyl Alcohol*

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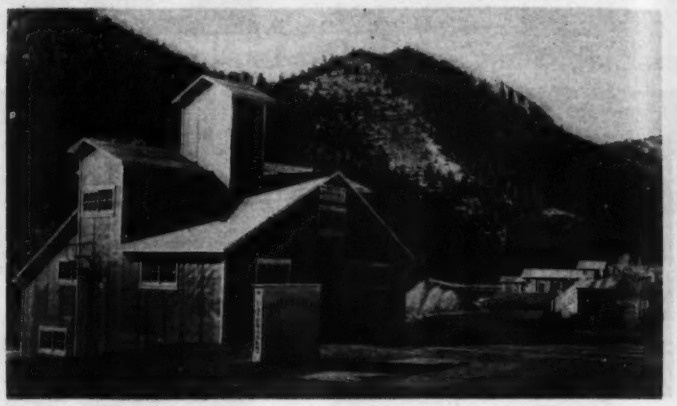


Above is pictured the Ruth custom mill, a compact, modernly equipped plant, in Idaho Springs, Colo., that treated about 14,000 tons of ore in 1940, from numerous small operations in the district

▶COLORADO

industries committee of Fairplay, Colo., with Dennis Stump and Kettner Rehbock as co-chairmen, has set up an organization to help non-local prospective members interested in mining in this section, and further the mining activities. Already the new organization is getting results. Engineering reports and maps of the section are available for interested parties applying to the Chamber of Commerce at Fairplay, Colo.

▶Henry Nelson, at Empire, has transferred his mining activities from the Silver Mountain territory to the Mint mine, and he expects to be operating soon. Development work in the Mint consists of several hundred feet of tunneling and drifts and is connected by crosscut with the Cashier workings. The Cashier mint is now being worked by J. H. Girard.

▶The Sweeney mill, at the Portland dump, at Colorado Springs, is preparing to increase its capacity to 225 tons daily. The present 125-ton mill was constructed and is operated by E. L. Sweeney.

▶Karl Egle has completed unwatering two levels and repairing the shaft on the old Morning Glory shaft, at Summerville. George Perrine and Ed. Hollowfield, of Nederland, are associated with Mr. Egle.

▶A new strike made in the King Solomon mine, near Columbine, in the Hahns Peak district, has caused some excitement at Steamboat Springs. The report states that ore found in shaft sinking ranges from a foot to eighteen inches wide and assays from $7 to $40 per ton in lead and silver.

▶Merrill E. Shoup, president of the Golden Cycle Corp., which owns and operates the largest custom mill for gold ore in the United States, reports that the earnings for the mill during 1940 equalled $3.13 per share, compared to $3.77 a share in 1939. This difference was partly offset by the difference for Federal and Colorado income taxes, which were $44,638 more in 1940.

▶Charles Gnaut, of Denver, is providing funds for the work of the Jewel claims in the Needle Mountain mining district, owned by M. G. DeLuche, of Durango.

UTAH

Elton Tunnel Nears Completion

Diamond drill holes from project will be directed to aid in draining Apex mine

▶Two months of work, it is estimated, will be needed to drive the Elton tunnel of the National Tunnel & Mines Co. near Tooele to its objective, 24,100 ft. from the portal. Progress is at the rate of 35 ft. daily. Beginning Feb. 18, nearly a month's time was taken to drive through 28 ft. of water, gravel, and broken rock in a fault zone. Water flow is 4,300 g.p.m. At 23,500 ft., the company plans to drill several diamond drill holes to the 2,500 level of the Utah Apex mine, where water is standing up to the 1,800 level. After draining the old workings, a connection will be made with the Rood Shaft at the 2,475 level. Previously, the Apex mine was worked to the 3,300-ft. level. Construction costs during a six-month period last year averaged $35 per foot; powder cost, $3.235 per foot. About 125 tons of rock are broken every round in the 11x12 ft. tunnel. Six rounds are averaged every 24 hours by the three shifts of workers. Mechanical loaders are used to load the 3½-ton cars.

▶Net proceeds valuation of Utah metal mines for 1941, as reported to the State Tax Commission at the Capitol, Salt Lake City, amounted to $70,647,785 as compared to $54,528,342 for 1940. The occupation tax for 1941 was $668,854.35, against $485,970.06 last year. Net proceeds valuation is computed by doubling the net proceeds reported by mines during the preceding twelve-month period.

▶Ohio Copper Co., operating at Bingham, reported for the year 1940 a net profit of $43,643, before depreciation and depletion, compared with a loss of $9,074

in 1939. Total copper production amounted to 2,207,085 lb. at an operating cost of 8.49c., reports Percy H. Kittle, president and general manager.

▶Drifting has been resumed at the Valeo Mines Co. property in East Park City after retimbering of the tunnel. Net smelter returns of $73 per ton have been received on ore shipped from the 250-level of the Hercules mine, Ben Harrison Gulch, Tooele County. The company is planning to sink the shaft to 550 ft. for development of the new ore.

▶The Bauer selective flotation plant of the Combined Metals Reduction Co. is treating 25,000 tons of zinc-lead ore a month, one-third coming from Pioche, Nev., one-third from the Hailey, Idaho, district, and one-third from Utah mines.

▶Trenching and sampling of a manganese deposit near Manila, Daggett County, have been started under the direction of Paul T. Allsman, engineer in charge of the mining division, United States Bureau of Mines, in the intermountain region. Russell R. Trengrove is in direct charge of the work. Samples along a fissure for a distance of 4,100 ft. are said to average near the surface from 10 to 35 percent manganese.

▶The Howell Mining Co. is cleaning out the Tom Moore tunnel at Alta for a distance of 2,000 ft. A raise is being driven preparatory to diamond drilling. J. J. Beeson is manager of operations.

▶Leasers are shipping ore at the rate of two carloads weekly from the Moscow Silver Mines, near Milford.

▶The Silver Prince Mines Co. recently shipped 60 tons of ore from its Ophir property, in Dry Canyon. The Treasure Hill Mines Co., at Ophir, has resumed sinking of the main shaft to develop ore opened on the 1,000-ft. level.

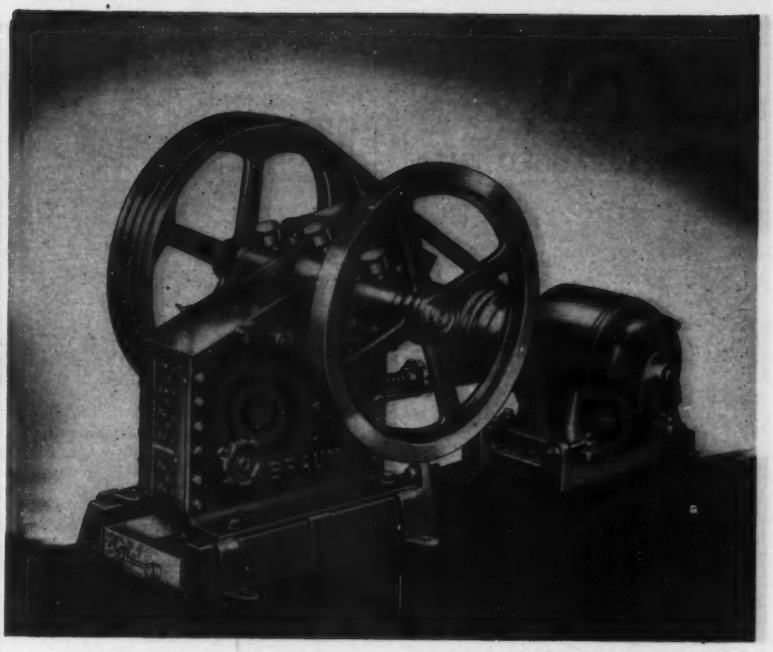
NEVADA

New Flotation Mill at Pioche Nears Completion

Plant of Combined Metals Reduction Co. expected to be ready in June—Copper Canyon Mining Co. ratifies agreement with International Smelting & Refining to develop its property

▶Construction of a 450-ton selective-flotation mill is well advanced at the Caselton mine of the Combined Metals Reduction Co. near Pioche, Lincoln County. E. H. Snyder, manager, with headquarters at Stockton, Utah, predicted that the plant will be ready to crush lead-zinc ore by June 1. Robert L. Dean is superintendent at Pioche.

▶At a recent meeting in New York, stockholders of the Copper Canyon Mining Co. ratified unanimously an agreement with the International Smelting & Refining Co., Anaconda subsidiary, under which International, with a renewed option on 2,000,000 shares of Copper Canyon stock at 25c., is to proceed with the development of the Copper Canyon and Copper Basin mines and will provide a mill of 300 tons' minimum



Braun Chipmunk Crusher, Type WD, with Motor and V-Belt Drive

CRUSHING STRENGTH

The power, speed and stamina of this big Braun Chipmunk Laboratory Crusher makes it first choice for the production speed-up that faces the nation. The Chipmunk handles a wide variety of materials, including metallic and non-metallic ores, cement clinker, coal and similar substances. Hard or soft, brittle or tough, this sturdy machine reduces them swiftly and completely.

With a jaw opening of 2⅜ x 4 inches, the Type WD Chipmunk Crusher has a rated capacity of about 800 lbs. of medium quartz ore, from 2¼" down to ¼" or smaller, per hour. No other crusher of similar dimensions can approach the Chipmunk in the quantity of material handled in a given time.

The Chipmunk is sturdily built to stand up under the heavy punishment of day-in and day-out hard rock crushing. It is available for either direct motor and V-belt drive, as illustrated above, or for shaft and pulley operation.

A smaller size Chipmunk, having the same outstanding, rugged, efficient construction features, has a rated capacity of about 400 pounds per hour.

Write Dept. E-5 for Bulletin C-131 for complete details

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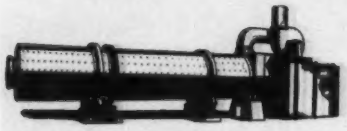

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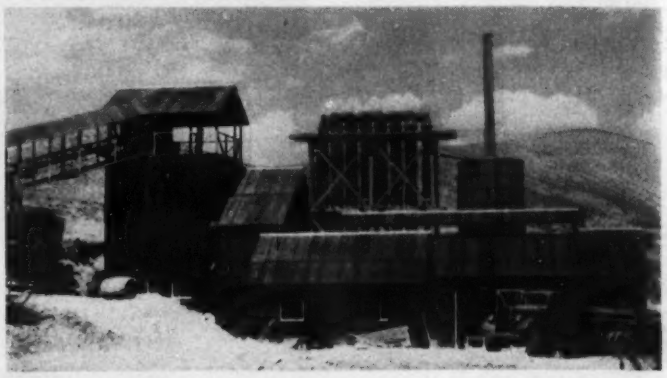

Quicksilver output in the United States in 1940 totaled 36,300 flasks of 76 lb. each. Production is now ample for all domestic requirements. The above new plant of Greenan Quicksilver, Inc., in the Battle Creek district of Nevada, will be a substantial producer in that State during 1941

▶NEVADA

capacity. J. J. Lillie, manager for the International-controlled Mountain City Copper Co., will be in charge of Copper Canyon operations, receiving mail at Battle Mountain, and Robert H. Raring remains as resident engineer. Louis E. Whicher has been elected president of the Copper Canyon Mining Co.

▶Installation of a sampler, to enable treatment of custom ores, has been completed at the new 200-ton all-sliming cyanide mill of the Adelaide-Crown Syndicate, 12 miles south of Golconda, in Humboldt County. Roy A. Hardy, consulting engineer for the Getchell Mines, Inc., heads the syndicate and is general manager.

▶Heads of the newly organized Cordero Mining Co., subsidiary of the Horse Heaven Mines, Inc., of Oregon, report that a twelve-hearth Nichols-Herreshoff furnace of the three-zone type is being constructed by the Pacific Foundry Co., of San Francisco, for early installation on the company's cinnabar property in northern Humboldt County. J. Edgar Pew, of Philadelphia, is president of the Cordero company.

▶In the annual report of the Mountain City Copper Co., Mountain City, Nev., J. O. Elton, president, stated that development and exploration in 1940 continued on the various levels along the same general program as conducted during the previous year. This involved the exploration of the Rio Tinto ore horizon, the footwall horizon, and the downward projection of mineralization. On this latter project 1,831 ft. of drifts, crosscuts, and raises were driven on or from the 1,000-ft. level. A heavy sulphide mineralization was encountered in this area, but to date no ore of commercial grade has been developed.

▶The mine produced 19,882 wet tons of shipping-grade ore and 126,994 wet tons of milling-grade ore containing 26,479,161 lb. of recoverable copper. At the mine plant and townsite, three new 667 kva.-transformers were installed to permit changing transmission line voltage from 44,000 to 6,000 v.

Leon Henderson Speaks On Copper Prices

Administrator of the office of Price Administration and Civilian Supply avoids formal ceiling on copper for the present

CEILING prices on copper and on brass ingot will not be fixed by a formal price schedule at the present time, Leon Henderson, administrator of the Office of Price Administration and Civilian Supply, announced April 25. He made it clear that the Government's goal is a uniform 12c. copper price and hopes for voluntary action to establish the market on that level.

"It is recognized," Mr. Henderson stated, "that the major portion of the copper industry has maintained a stable price of 12c., but that a minor section has been selling at the socalled outside price which has ranged up to 13½c. or more. This price disparity is unwarranted. Furthermore, while the amount of this outside copper is not a large percentage of the total copper sold, its price, and that of copper and brass scrap and ingot, seem to move together. Thus, the price of ingot has exceeded what is considered a reasonable level.

"At meetings held in Washington," Mr. Henderson went on to say, "members of the copper and brass ingot industries expressed the opinion that the situation is not out of hand to such an extent as to require formal ceiling prices. They urged that an attempt be made to correct the situation through cooperation of the industry with the Government. This Office is eager that producers have the opportunity by their individual actions to stabilize the market. Therefore, it is suggested to all copper producers selling at more than 12c. that they gradually reduce their prices until a uniform maximum price of 12c. is established for all copper, both primary and secondary. Similarly, the suggestion is made to the brass ingot producers that they reduce their prices. Our goal is a uniform 12c. copper price and a price for brass ingot which is in proper relation thereto."

The following maximum prices are

suggested by OPACS, effective immediately:

Primary producers who are now selling or offering to sell at 12c. should continue to do so.

Primary producers who are now selling or offering to sell at more than 12¼c. should reduce their selling price so as not to exceed 12¼c. All custom smelters should sell not in excess of 12¼c.

Casting copper producers should sell at prices not exceeding 12¼c. 85-5-5-5 ingot should sell at prices not exceeding 13c.; and other ingots at the usual differentials.

"The differential suggested above between the maximum prices of custom copper and brass ingot," Mr. Henderson explained, "should not be considered as final. The question involved is a complex one to which we have given careful consideration. We are willing to see how the suggested differential will operate in practice and, on the basis of our experience with it, reexamine the question in order to achieve the most desirable distribution of the available supplies of scrap."

Mr. Henderson, however, cautioned that "if it appears that the individual producers are unable to carry out the suggestions of this Office, we shall be forced to take other steps to maintain price stability. In the event that a price schedule does prove necessary, contracts entered into after April 25, 1941, at a price exceeding those suggested above, will not receive special consideration."

In conclusion, Mr. Henderson stated that "if the individual members of the industry believe that they are able, in cooperation with this Office, to correct a bad situation without formal action by this Office, and ask a chance to do so, they will be given that opportunity. This Office will then follow a policy of 'watchful waiting' and will step in as soon as it becomes apparent that formal action is the only corrective."

MICHIGAN

Subsidy Sought From OPM For High-Cost Mines

Companies seek to obtain a scale applicable to copper properties in Michigan and elsewhere which cannot produce for defense successfully with copper at 12c.

▶ Subsidies for mining companies in the Michigan copper district the operating costs of which are high have been proposed by these interests. The Office of Production Management has been asked to recommend a subsidy for high-cost mines, with different companies receiving different amounts according to operating expenses. This subsidy scale would apply to mines in Michigan and other sections where production costs approach the present price of 12c. Subsidies would not be required for producers whose costs were below a specified figure. It might, on the other hand, enable mines now closed to reopen, thereby providing employment and assuring an adequate reserve of the metal for defense purposes.

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These special type Sand Distributors were designed by Western Machinery Company for the Lava Cap Gold Mining Corporation in early 1940 and have operated regularly since then with unusual economy.

Although 50 feet in diameter the distributor mechanisms are driven by 1/4 HP Gearmotors at 1/3 RPM, producing a smooth and even distribution of sands from the classifiers.

The maintenance costs of these units cannot be reckoned yet, because they have cost nothing beyond the negligible amount of power needed to run them and the oiling of bearings.

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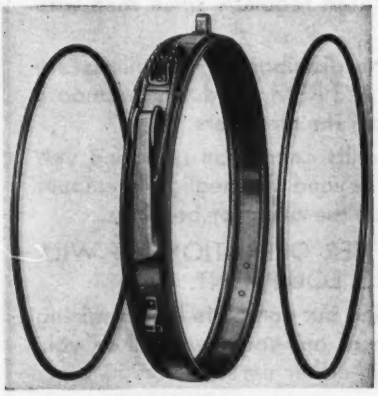

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IDAHO

Addition to Bunker Hill Mill Being Constructed

New unit will be added to provide for sink-and-float process of ore treatment—Plant capacity of Coeur d'Alene mines to be doubled to 600 tons per day

▶ Bunker Hill & Sullivan Mining Co., at Kellogg, is making plans for a milling plant for a sink-and-float process with capacity of erecting 1,400 tons of ore daily. Design for the unit will be drawn by W. L. Zeigler, millright, according to announcement by J. B. Haffner, Bunker Hill manager. The plant will be partly a new addition and partly a redesigning and rearrangement of the present plant. Experiments with the H & H sink-and-float process have been carried on for the past year at the Sullivan Mining company's Star mill, at Burke. These experiments have demonstrated that at least one third of the mine-run material can be deleted from the mill feed, thereby increasing the grade of ore milled and making it possible to increase the tonnage milled with no appreciable increase in cost for labor, power, or machinery. The Bunker Hill & Sullivan annual statement of 1940 mine operations shows a net profit of $854,351 after all charges, including depreciation, depletion, amortization, interest, and federal income, defense and excess-profits tax, amounting to a total of $500,962. The profits are equal to 61c. a share on common outstanding stock after $52,223 of preferred dividend requirements are taken care of. The 1940 net profit is $986 in excess of the $853,365 made in 1939.

▶ Production capacity of the Coeur d'Alene Mines silver property is to be increased immediately from 300 to 600 tons a day, according to plans of the board of directors announced at the annual stockholders' meeting held in Wallace recently. The old board of directors, consisting of Dr. H. C. Mowery, of Wallace, president; Dan Leary, of Burke, vice president and manager; and L. J. Randall, secretary-treasurer, was re-elected. John M. Simpson, of Gem; Harry Groner, of Kellogg, and P. F. Scheble, of Wenatchee, Wash., were re-elected to complete the directorate. According to the report of Secretary Randall the company's profits for the first quarter ending March 31, 1941, amounted to $101,097.29 after deducting estimated taxes and other costs. The company's annual report for 1940 showed a net income for that year of $170,068.10, and President Mowery predicted the company would net $400,000 for the year ending December 31, 1941.

▶ According to the fourth annual report from the Polaris Mining Co., operating the Polaris silver property adjoining the Sunshine, covering operations for the year 1940, the company made net profits of $346,744.83 after deducting all charges except depletion, compared with profits of $202,920 in 1939. During the year the company milled 48,866 tons of ore, which produced concentrates containing 1,107,694 oz. of silver.

▶ Hecla Mining Co.'s 43d annual report, covering operations for the year 1940, shows net earnings of $793,414.45, compared with $578,034 for 1939 and $718,715 for 1938. Dividends paid during the year amounted to $600,000, making the total dividends up to the close of 1940, $23,705,000. Taxes for 1940 amounted to $389,386.77, or 32.92 per cent of the profit before taxes.

▶ Improved highways are bringing increased activity to the almost inaccessible area of east central Idaho. In the Yankee Fork mining district, in Custer County near the confluence of the Yankee Fork and Salmon Rivers, the Snake River Mining Co., a subsidiary of Silas Mason Co., Inc., New York contracting firm, has installed the largest gold-mining dredge in the Pacific Northwest at a cost of approximately $600,000, and has carried on winter operations with little interruption, although the elevation is at 6,200 ft. The company has more than 15,000,000 cu.yd. of dredgeable gravel in a distance of seven miles along the Yankee Fork.

▶ On Custer Mountain, at an elevation of 8,200 ft., and immediately above this dredge ground, the Custer Consolidated Mining Co. has a 70-ton ball mill in operation on the old Lucky Boy mine, and carried on continuous operations throughout the winter. The gold and silver ore is from the newly discovered Calcite vein.

▶ On the Black mine, immediately adjoining the Lucky Boy, the American Dollar Mining & Milling Co. (owners) is carrying on development work under the direction of C. P. Venstrand. About 7,000 ft. of development work has been done on six levels. Four substantial oreshoots have already been cut on the vein carrying gold and silver. Early in May efforts to block out this ore, estimated by Venstrand at 60,000 tons, will be made. In the event blocking justifies this estimate, a 50-ton ball mill with flotation will be installed during the summer.

WASHINGTON

Northwest Magnesite Co. Grants Wage Increase

Vacation with pay and pension plan also given to workers —Operations of company at capacity

▶ Northwest Magnesite Co. has increased by 5c. an hour the wages of all employees and has announced several other concessions to the men. The increase for the 700 employees will amount to more than $100,000 in a year, according to E. A. Garber, general manager of the company's operations at Chewelah. The company will give one week of vacation on pay to all who have been at least one year in its employ. It has adopted a pension plan on the retirement basis, the expense borne by the corporation; also, a group life insurance plan, with the cost divided between the employees and the company. Operations are at full capacity, seven days a week, three shifts daily.

▶Double Eagle Mining Co. has given to Westvaco Corp., of California, a renewal of its option to purchase the company's 296 acres of magnesite-bearing land near Valley, south of Chewelah. The option expires June 1, but Mike Kulzer, president of the Double Eagle, says he does not expect the California firm to take up the option or ask for its renewal, for the Westvaco firm has acquired six magnesite claims near Luning, Calif.

▶Olympic Mines Co. is building a small electrolytic manganese recovery plant at Hoodsport, on the Olympic peninsula. A. E. Schrimpf, president, says the plant will go into operation in July. The company is said to have a vein containing cinnabar and manganese with enough ore in sight for three years' operation. It paid $28,000 for a large motor in Spokane, which it trucked across the State to the new mill. The company has patents for the process it will use. Forty men will be employed when the plant is in operation.

▶American Zinc, Lead & Smelting Co. reports that its total investment in the Grandview mine and mill, at Metaline Falls, is $94,696. American Zinc, the parent company, says its investigations show that the ore can be mined at relatively low cost. The mill started in September, 1940, and by the end of the year had treated 15,756 tons of ore, producing 1,633 tons of zinc and lead concentrates. In the same period, Metaline Mining & Leasing Co., also operated by American Zinc, produced 24,859 tons of ore, making 2,946 tons of zinc and lead concentrates. This production also was at the Grandview mill. American Zinc reports it has expended a total of $648,347.88 in its investment and advances at the property of Metaline Mining & Leasing Co. Development results were satisfactory, says the report.

OREGON

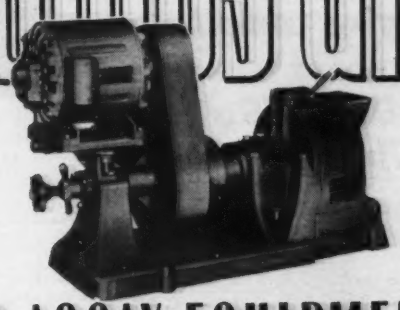
Cornucopia Gold Mines May Increase Mill Capacity

Company expects to complete Clark Tunnel extension this year for development of additional veins

▶Cornucopia Gold Mines Co. was again the heaviest producer of gold in the State in 1940, with an output of $816,000, from approximately 50,000 tons of ore milled. In the year 13,385 ft. of development was done, consisting of 5,159 ft. of drifting, 6,767 ft. of raising, 193 ft. of shaft and 1,266 ft. of 8x8-ft. tunnel work. The company's chief development was the extension of the Clark tunnel 4,500 ft., which will be completed this summer or fall. It will cut veins which are expected to be as productive as the present Union Companion vein. Three hundred men are employed and plans are under consideration for increasing the mill capacity from 150 to 250 tons a day. This will enable the company to handle the ore from the Simmons mine, adjoining. The property is 75 miles from Baker. A. V. Quinn is manager.

▶Horse Heaven Mines, Inc., was the second largest producer of quicksilver in

it's "THUMBS UP"



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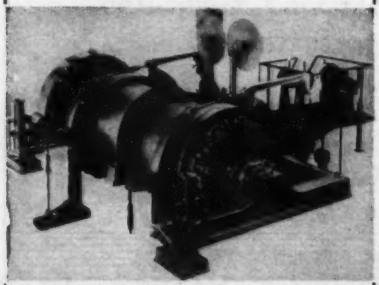


OTTUMWA IRON WORKS

OTTUMWA, IOWA, U. S. A.

In continuous operation since 1867

P. R. Bradley, president, reports that Alaska Juneau Gold Mining Co. mined and trammed to the company's mill shown above, more ore in 1940 than in any previous year. The 5c. decrease in ore values, however, offset the advantage of increased tonnage. The company reports a net profit for 1940 of $721,698

▶OREGON

1940. The property is 43 miles east of Madras. The company's mill handles 50 tons of ore per day. In the year it averaged 165 to 175 flasks per month.

▶ Robert Radcliffe has been working the Black Bear mine, in the Galice district, since 1930. Oxide gold ore is mined from open cuts and crushed in a small mill to 50 mesh and run over amalgamation plates.

▶ Between 500 and 1,000 tons of ore are shipped monthly from the Bourne district to the Tacoma smelter. The ore comes from the operations of John Arthur and other leasers.

▶ W. F. Burns, Fred Kubon, and Miles Rombough, leasers of the Hidden Treasure mine, near Baker, have a small cyanide plant and have made several shipments to the Tacoma smelter.

▶ Boulder Creek Placers, on Boulder Creek in Grant County, are being operated by Clarence Thomas and Joe Davis, both of Granite. They have a floating washing plant of 900-cu.yd. capacity and a 1¾-yd. dragline shovel.

ALASKA

Gold-Dredging Operations Well Under Way

New large unit of United States Smelting & Refining Company expects to start work before end of current season

▶ N. W. Rice, president, United States, Smelting, Refining & Mining Co., in his annual report for 1940 stated that at Fairbanks, Alaska, dredging operations started for the season on March 13 and continued until Dec. 7. All of the eight dredges were operated, including the two new dredges referred to in last year's report, the newly acquired small dredge starting on May 3, and the newly constructed large dredge starting on Aug. 8. In all, the dredges aggregated 1,799 dredging days, compared with 1,462 dredging days in 1939. The yardage handled in 1940 was larger and of higher average grade than in the previous year. At Nome, Alaska, dredging operations started for the season on May 12 and continued until Nov. 21. The three dredges on this property aggregated 567 dredging days, compared with 483 dredging days in 1939. Yardage handled was considerably greater than in the previous year, with average grade about the same. The new, large, deep-digging dredge which was ordered in 1940 is now under construction and, barring delays in delivery, should be put to work before the end of the 1941 season. At both the Fairbanks and Nome properties the gold output for the season was the highest in their history, due to the fact that the two new dredges at Fairbanks operated a part of the season. Acquisition and development of additional dredging ground and preparation of ground ahead of the dredges have been actively continued, with the result that the gold reserves and the yardage of prepared ground were greater at the end of 1940 than at any time in the past. Six of the company dredges have begun spring operations in the placer district beyond Fairbanks.

▶ Fire during the winter destroyed the old mill of Alaska Pacific Consolidated Mining Co., in the Willow Creek district. It handled about 20 tons of gold ore per day from the Skyscraper and the Free Gold properties of the Alaska Pacific Co. Most of this company's ore, however, is milled at the Independent plant, a quarter of a mile distant.

▶ Yellow Band Gold Co. on Golconda Creek, Bremmer River district, expects to have a better season this year, for last season it was handicapped by the loss of some of its buildings and equipment in snow-slides, which also carried away the terminal of the upper tram. Asa Baldwin, engineer and manager of the company, says ore will be trammed from the mine to the lower tram terminal and hauled by tractors and trucks to the mill.

▶ Two tractors haul 10 tons of antimony ore each trip over a 50-mile road, to Lignite, a station on the Alaska railroad where the ore is stacked awaiting better prices for the metal. It is destined for the National Lead Co.'s smelter at Perth Amboy, N. J. The ore is hauled on sleds, on one of which a small house, equipment, and boarding facilities are carried for the crew. The product comes from the mill at Stampede. Earl R. Pilgrim, manager, says the mill will not be operated this summer unless antimony prices are higher.

TRI-STATE

Heavy Rains Damage Many Zinc Properties

Oronogo open pit filled with water and many mines in southern Picher field flooded—Eagle-Picher Mining & Smelting Co. constructing additions to buildings at smelter

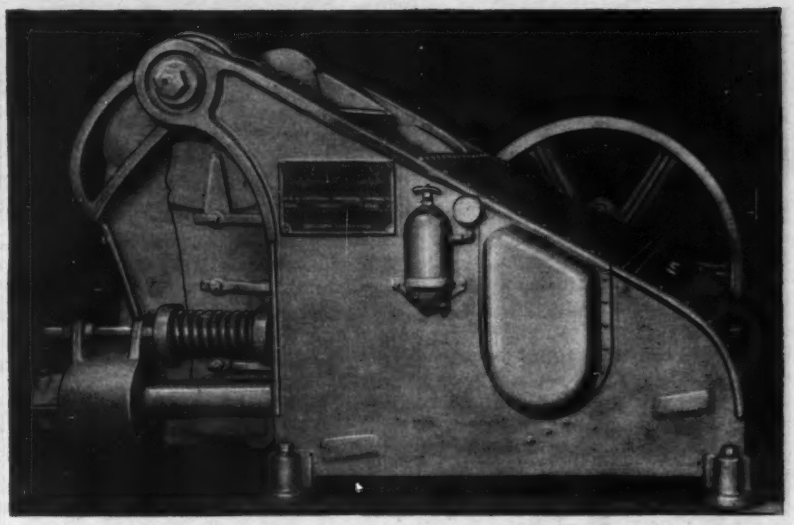
▶The month of April in the Tri-State was marked by the most serious flooding of mines in the history of the zinc-lead mining district. Greatest damage was at Oronogo, although the south-central part of the Picher field was hit hard. Tons of water from swollen Center Creek broke the barrier over the Cochrane shaft in the Oronogo bottoms and gushed into the underground workings for a 56-hour period before the raging creek could be brought under control. The effect was nearly disastrous to the mines in that section, causing thousands of dollars' damage to the operating companies. Shortly after the flood, the Eagle-Picher M. & S. Co. suspended pumping operations in the Oronogo-Webb City field to await leveling off of the flood waters and to survey the situation before reaching a decision to dewater the area again. Operating mines in the area affected were the famous open-pit mine of the Oronogo Mutual Mining Co. and the properties of the F. & M. Mining Co. and Fenix & Sons. In the Picher field, Lytle, Tar, and Chat creeks flooded several mines, doing considerable damage. Water overflowed into the old Acme mill shaft and an abandoned shaft on the Admiralty lease. Mines most seriously affected were those on the Acme-Mahutska, Whitebird, Admiralty, and Jay Bird and the Rialto fee. It will take some time to pump out the lower workings at several of the properties. Water from the heavy rains also flooded the Opperman mines of the Lula Bell Mining Co., near Baxter Springs, with considerable damage also.

▶Another event of the month was the acquisition of the stock of the Skelton Lead & Zinc Co. by the officers and stockholders of the Davis-Big Chief Mining Co. Consideration, or terms, involved in the deal were not disclosed. The transaction included the mines and mill of the Skelton company on the 200-acre Mary Calf allotment, just east of Douthat, in the southeast portion of the Pitcher field.

▶In conjunction with the enlargement of the zinc oxide and white lead divisions at the Galena smelter of the Eagle-Picher M. & S. Co., additions are being built to the laboratory, office, and bathhouse buildings in the east yards of the plant to provide facilities in keeping with the expansion program, according to Ray L. Hallows, of Joplin, plant manager.

▶With the recent closing of the Pelican mines of the Davis-Big Chief Mining Co., the Eagle Picher M. & S. Co. has suspended milling operations at the company's Bird Dog central mill, two miles west of Picher.

DOLLARS SAVED
(at mine in Peru)
On Crushing Operation



Kue-Ken Crusher replaces ordinary crusher and pays for itself in three weeks' operation

Power used; less than half. Mill capacity; Up 32%. Jaw plate wear; 1/9c per ton. Ball consumption in grinding; down 10%. Time lost on repairs to crusher; NONE.

That's the way the data furnished by mine owner in Peru reads in his report of results obtained since the Kue-Ken No. 20 was installed. This 6 x 12 Kue-Ken crusher weighing only 4000 pounds replaced an ordinary 24 x 12 crusher weighing 25000 pounds. Power was reduced from 35 HP to 15 HP, and with Kue-Ken jaws set ⅝ to ¾ inch the mill capacity was increased from 7.28 tons per hour to 10.71 tons per hour . . . 32% more capacity. And that isn't all: the mill product with the previous crusher was 62% minus 200 mesh while with the Kue-Ken it is 70% minus 200 mesh which gives correspondingly better recovery by cyanide process. Ball consumption dropped from 1.1 kilos per ton to .9 kilos per ton because the Kue-Ken delivers a finer mill feed. The same medium hard, run of mine quartz being handled. Owners say: "the Kue-Ken paid for itself, transportation and installation in the first three weeks' operation". Name of this owner will be sent on request.

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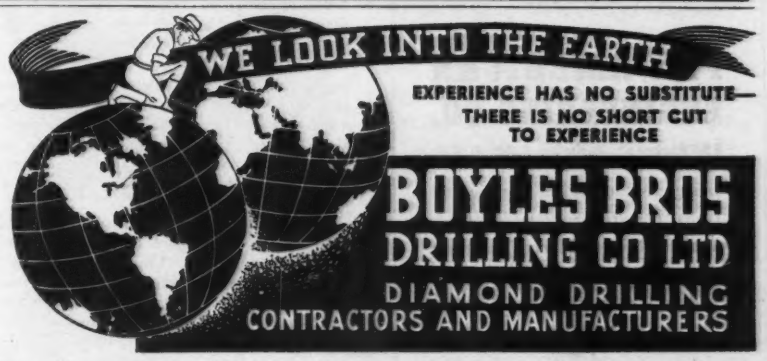

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Large trucks that hauled zinc ore from the surface workings of the Oronogo mine, in Missouri, are now idle as a result of heavy rains that flooded creeks and overflowed into the open pit

Domestic Zinc Producers Consider Defense Problems

Production priorities and price are discussed by Government representatives and others on program of American Zinc Institute

MEETING AT ST. LOUIS in annual convention on April 28 and 29, zinc producers of the United States gave serious attention to problems growing out of the demand for zinc in national defense. In opening the convention, President Howard I. Young reminded his audience that the Institute had been born of war-time necessity during the first World War, and was now confronted with problems similar to those that led to its organization years ago. At that time production was about 670,000 tons of zinc per annum, with an estimated capacity of 800,000 tons. In 1940, production was 724,000 tons. In 1941, the industry will turn out 870,000 tons and is headed toward the million-ton mark in 1942.

Reporting on the work of the Institute for the past year, Secretary Gent explained the necessity for modifying the activities of the secretary's office to meet extraordinary conditions growing out of the program for national defense. Relations with the Office for Production Management and other defense agencies in Washington put heavy demands on the secretary's time and on the facilities of his office. Still further demands will grow out of the subpoena served by the Department of Justice on the Institute and its officers for alleged violation of the anti-trust laws. Government investigators have been invited to examine the Institute's records and the examination is now in process.

The Traffic Committee of the Institute warned producers that a car shortage is impending. Congestion of railroad facilities will increase as priorities become more common. Prospective bumper crops will add to shippers' difficulties this fall, and further pressure will result from abandonment of some coastwise shipping.

John A. Church, consultant on copper and zinc for OPM, came from Washington to discuss with producers and problems of production and use of zinc. He assured the audience that there is now and will be enough zinc for all defense purposes and for the essential needs of the basic national economy. This does not mean that there is also plenty of zinc for non-defense needs. There is not, nor will there be. But military needs will be met, as well as those that are non-military but essential to the military program.

Some form of directional control of zinc use is necessary if essential needs are to be met promptly. Initially this is being accomplished by setting aside a percentage of the monthly production for priority allocations of the metal. For April this quantity was 5 percent; for May 17 percent. Mr. Church saw no escape from this trend. He expressed satisfaction over his relations with zinc producers and asked them only to continue their fine cooperation.

In contrast with Mr. Church's remarks, which were accepted as realistic and practical, an address on price stabilization by P. M. O'Leary, of the Office of Price Administration and Civilian Supply, was not so well received. Mr. O'Leary's philosophy of avoiding the evils of price spiraling by controlling the behavior of prices was accepted as desirable; but he and the producers were sincerely at odds over his contention that the price of zinc had been stabilized at a reasonable level and should not be allowed to rise at this time. Mr. O'Leary stated that the price of zinc had risen, relatively and absolutely, higher than that of the other major non-ferrous metals, and he doubted if the public welfare would be served if the price were allowed to rise further. He felt that expansion of production had already responded to the rise in price; also that it would be unwise to raise

the price of zinc concentrates in order to stimulate more domestic production to displace imports of foreign concentrates. He expressed the belief that the American people would approve the anti-inflation measures being taken by OPACS.

One session of the convention was devoted to the zinc concentrate situation at home and abroad. The subject was handled in a round-table discussion by speakers from various parts of the country. E. W. Pehrson, of the Bureau of Mines, gave a comprehensive picture of the available supply of concentrates from domestic and foreign sources. In general he confirmed Mr. Church's opinion that the supply will be adequate to meet requirements for 1941, regardless of what may happen to ocean shipping. An apparent deficit of 12,000 tons of concentrate, without recourse to further imports, is easily overbalanced by estimated deliveries of foreign concentrates of 288,000 tons during the remainder of 1941. He forecast only a 7 percent increase in domestic mine output for 1941, emphasizing the fact that the zinc industry in the United States has reached maturity and cannot yield the increases shown from 1914 to 1917. It is suffering from a combination of rising costs, declining grade of ore, decreasing ore reserves, inadequate prices, poor tariff protection, and discouragement of private enterprise in prospecting, exploration, and development.

On the whole, Mr. Pehrson presented a rather pessimistic view of the future of the domestic zinc industry.

Speaking for the Tri-State District, Evan Just, secretary of the Tri-State Producers Association, said that under present conditions of cost and price, the output of zinc concentrates is likely to decline from the present rate of 9,000 tons a week. Few operators are making money; some are merely breaking even. One-fourth of the production is without profit. Higher prices for concentrates, say $60 per ton, would probably bring out more zinc but would not compensate for the lack of prospecting and exploration which has been conspicuously inadequate in the past few years.

R. B. Caples, of the Anaconda Copper Mining Co., Great Falls, Mont., reviewed the concentrate situation in the West. The zinc industry in that part of the country has suffered from the ills outlined by Mr. Pehrson, but the production of cencentrates from Western states in 1941 will probably show a 10 percent increase over that of 1940, with a like increase in 1942. Some upward adjustment of the tariff must be provided if the domestic market is to be protected against imports.

Howard I. Young presented a statistical study of production, consumption, and stocks of slab zinc in the principal countries of the world. He judged that the amount of zinc available to industry for uses other than national defense will be equivalent to between 70 percent and 80 percent of the average requirements in the five-year period 1935-1939.

Officers for the ensuing year were elected as follows: Howard I. Young, president; C. Merrill Chapin, Jr., J. O. Elton, John A. Robinson, vice presidents; J. L. Good, treasurer; Ernest V. Gent, secretary.

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Bulletin No. 71 describes briefly over 75 different types of Koppel cars designed to reduce tonnage costs and speed up production.

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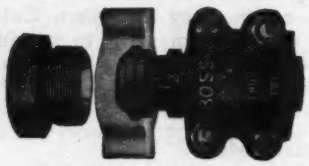

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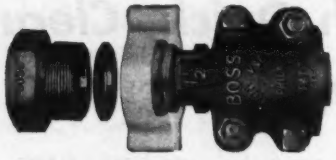

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Same as above, except head of stem and coupling end of spud are faced flat to accommodate washer. Sizes ¼" to 4" inclusive, with 4-bolt "BOSS" Offset Interlocking Clamp on 1" and larger; 2-bolt Interlocking Clamp on ⅞" and smaller.

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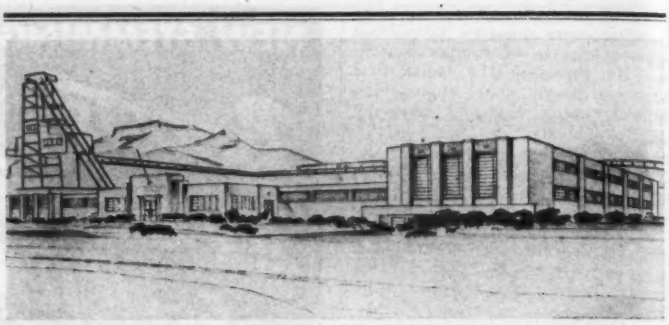

Perspective of the new office buildings, change house and machine shops around the new iron ore mine of the Cleveland-Cliffs Iron Company on the Marquette range, near Ishpeming, Mich. Glass blocks will be used in the buildings, which will be of steel and brick construction. The Austin Company started erection early in May

IRON COUNTRY

New Record Set By Iron-Ore Ships

Earliest resumption of traffic since 1902 made on April 15—Many mining companies give wage increases to employees

▶ The 1941 navigation season had the earliest opening on record. The steamer "Cadillac," of the Cleveland-Cliffs Steamship Co., docked, loaded with iron ore, at Presque Isle harbor on April 5, the earliest opening since the record was established by the "Crescent City" on April 6, 1902. A total of 56,000 tons of iron ore was shipped from the Lake Superior and Ishpeming railway company's dock at Presque Isle on the first day of the 1941 navigation season.

Geogebic Range

▶ For the first time in many years mines on the Geogebic range started hoisting on April 1; and on April 11, shovels in the open pits started excavating certain grades of ore to fill specification of an Escanaba order.

▶ The Yale mine property of 80 acres of the Jones & Laughlin Ore Co. was recently purchased by William Trebilcock, of Ishpeming, for real estate purposes. Headframe and old machinery have been sold for scrap.

Marquette Range

▶ About 225 employees of the Cambria mine of the Republic Steel Corp. recently received a pay increase. The announcement was made on April 14 by Thomas A. Flannigan, mine superintendent. For an 8-hr. shift, five days per week, an employee would receive around an additional $4 per week. Overtime pay was also increased under the new basis. Employees of the Oliver Iron Mining Co., a subsidiary of the United States Steel Corporation, were also notified of a wage increase by LeRoy Salsich, president, in a letter as follows: "Effective April 1, 1941, and until further notice, there will be an increase in wages paid to the employees of 10c. per hour worked whether the positions be compensated on an hourly, incentive, tonnage, or a combination rate basis). This extra pay shall be in addition to the earnings at the present regular rate. An adjustment on an equitable basis will be made in salaries of less than $4,000 per year. Effective for the year 1941 the vacation plan will be a one-week vacation with pay for those wage earners with three years or more continuous service prior to July 1, 1941, and a two weeks' vacation with pay for those wage earners with fifteen years or more continuous service prior to that date provided in each case the wage earner shall have received earnings in at least 60 percent of the pay period since July 1, 1940. If, in the opinion of management, this vacation program interferes with the attainment of maximum production and the proper expedition of the national defense program, at the option of the company any eligible employee may be required to continue work and receive vacation pay in lieu of actual vacation from work." Employees of Cleveland-Cliffs Iron Co., Hanna Iron Ore Co., and North Range Mining Co. announced a similar daily wage increase.

CANADA

New Underground Shaft At Creighton Mine

International Nickel Co. also expects to start production from Strobie mine—Teck-Hughes Gold Mines finds encouragement in preliminary results of deep prospecting

▶ In the annual report of the International Nickel Co., President Robert C. Stanley stated that all of the company's mines were operated continuously during 1940 and the tonnage of ore extracted again registered a substantial increase. Shaft sinking was completed at the Garson mine in August. The surface plant is nearing completion and underground development is progressing rapidly. Schedules call for this new shaft and surface plant to commence ore pro-

duction late in 1941. Development work in connection with sinking a new underground shaft at the Creighton mine was continued and actual shaft sinking will be started during the summer of 1941. The new crushing plant at the Frood open pit was put into service during August last. This plant will also crush ore from the Stobie open pit, from which ore production is scheduled to begin by mid-year of 1941. A shaft will be started at the Stobie Mine in 1941 to bring this large low-grade orebody into production.

▶Development work was carried on at a rate to conform with ore requirements. The total development advances of shafts, drifts, and crosscuts, raises, winzes, and box holes was 56,609 ft., bringing total underground workings in all mines to 835,022 ft., or approximately 158 miles. Notwithstanding the accelerated pace of mining operations, accidents were held to a minimum, the following table showing 1940 to be a most satisfactory year in this respect:

	1936	1937	1938	1939	1940
Accidents per 1,000 shifts	0.145	0.135	0.083	0.080	0.077
Shifts lost per 1,000 shifts	6.05	5.25	4.32	3.59	4.30

▶The capacity of the concentrator was enlarged and additional equipment was installed in the smelter. Metallurgical results were very satisfactory. Losses of metal in tailings were reduced for the tenth consecutive year. Further expansion of mill capacity is in progress. The capacity of the nickel refineries was augmented and there was a marked increase in the production of refined nickel. The electrolytic copper refinery, the rolling mills, and the foundry were operated at full capacity. Other plants operated by the company for the production of hydroelectric power, coal, sulphate of soda, and fabricated products were operated continuously. As a result of heavy expenditures for maintenance, additions, and betterments, all plants are in a most satisfactory condition to produce maximum output of high-grade products.

ONTARIO

▶New ore possibilities at Teck-Hughes Gold Mines are now undergoing intensive exploration. The new hanging-wall veins are located in the No. 6 fault, south of the main vein. Satisfactory results have been reported from preliminary work on this structure down to the 40th level, but the full effect on bolstering up Teck's dwindling ore reserves will not be known until later. On the 35th level, at 4,250 ft., a crosscut reaching 600 ft. south of the main vein to the No. 6 fault has intersected five veins, of which the "Q" and "R," the two farthest to the south, appear to be the most promising. This is regarded as one of the most important developments since 1936, when the main vein was found to be petering out on the 50th level at 6,100 ft., and no encouragement was given by diamond drill holes put down 550 ft. deeper. Daily production is now averaging 800 tons, compared with 1,300 tons a day in 1936. J. G. McMillan is general superintendent.

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new levels, down to 1,550 ft., Preston East Dome Mines announces that plans are being made to double mill capacity to 1,000 tons daily. Victor A. James is mine manager and D. G. H. Wright managing director.

▶ Shaft sinking at Madsen Red Lake Gold Mines has been completed to the eighth level, at 1,250 ft. and a large-scale development program will be started after the break-up, when water transportation can be used to bring in transformers and the new hoist.

▶ Production at Berens River Mines has advanced to 250 tons a day, with recoveries averaging $15.36 a ton. Excellent ore conditions have been found on the three deepest levels, but tonnage estimates can be made only after more development work has been carried out. H. DeWitt Smith, of New York, is president and John Dryborough, of Winnipeg, vice president.

▶ Uchi Gold Mines, in spite of encouraging developments recently reported on several levels in the South workings, is having trouble maintaining mill heads. Production in February averaged $4.57 a ton and for the first full year of operation bullion totaled $1,299,789. At the end of 1941 a 6 per cent $1,000,000 bond issue comes due and Uchi also has heavy commitments for bringing three properties into production, the Grassett, Jalda, and Hanalda. The president, John E. Hammell, holds demand notes for $350,000, but payments will be deferred until other obligations have been met. A new mine policy is to be worked out after a detailed study has been made of the whole situation. Louis Foran has been appointed mine superintendent and A. G. Hattie general manager.

QUEBEC

▶ Canadian Malartic Gold Mines, at present producing 800 tons daily, plans to step up capacity to 1,000 tons by the end of this year. Ore reserves showed an increase of 100 per cent in the East orebody, close to the Sladen Malartic boundary. Mine average has improved in the last three months, as millheads reflect higher values in the lower sections.

▶ Efficient operations at Wood Cadillac Mines have resulted in reducing indebtedness from $275,000 to about $200,000. Gold extraction is holding at 95 per cent for average recovery of $5.65 a ton. Operating costs are about $4.10 a ton. The milling rate has been advanced 10 tons above rated capacity of 225 tons daily. Julius M. Cohen is consulting engineer.

▶ Sullivan Consolidated Mines had record production in 1940, with a total of $1,247,705 and average recovery of $10.08 a ton, according to the annual report of the president, J. Romeo Gavreau. Ore reserves amount to 407,542 tons, of which 162,802 tons are above the 350-ft. level and 169,406 tons are on the two deepest levels, at 1,050 and 1,150 ft. The mine operates at the rate of 360 tons a day. Pierre Beauchemin is managing director of Sullivan, the only producing mine controlled by French-Canadians.

BRITISH COLUMBIA

▶ Revenue from production at Bralorne mine, in the Bridge River district, largest gold producer in western Canada, reached a new high during 1940, according to the annual report of Bralorne Mines, Ltd. Earnings per share, however, have decreased, owing to wartime taxation. Austin C. Taylor, president, states that the satisfactory increase in ore reserves, the splendid condition of the mine, and the encouraging results obtained in outside exploration justify a feeling of optimism. Ira B. Joralemon, consulting engineer, states that results were at least equal to expectations in development where ore had been expected. Estimated ore reserves on Dec. 31, 1940, totaled 815,000 tons, averaging 0.49 oz. of gold per ton. D. N. Matheson, general manager, reported that a larger hoisting unit had been installed at the Empire shaft, where servicing of timber and supplies is now carried on, increasing the general efficiency of operations.

▶ Spud Valley Gold Mines, Ltd., has obtained full possession of the North Star group of claims, in the Zeballos area. Considerable prospecting and development work has been done on these claims and some promising orebodies have been discovered.

▶ Estimated ore reserves on Jan. 31, 1941, were 435,456 tons averaging 0.417 oz. of gold per ton, and valued at approximately $7,000,000, according to the annual report of Cariboo Gold Quartz Mining Co., Ltd., for the year ending on that date. Net earnings per share were less in 1940 than in 1939, but dividends were increased from 21c. to 24c. per share. The most encouraging development of the year was the cutting of the "B. C" vein on the 15-Main crosscut. This lead has a width of 4.5 ft. of solid quartz at point of intersection and this is adjoined by 10.5 ft. of broken-up schist, bearing small stringers of quartz. The average assay of the solid quartz was 0.45 oz. per ton. This mine had a production of 43,380 oz. of gold, valued at $1,688,643, during the year.

▶ Sheep Creek Gold Mines, Ltd., Nelson district operator, has issued a statement covering the nine months ended Feb. 28, 1941. During that period 40,883 tons of ore were milled, producing bullion valued at $731,018.

▶ Placer mining gives every indication of more activity than usual this year. The B. C. Chamber of Mines has conducted an active campaign to interest United States dredging operators to move into this province and these efforts have been, to some extent, successful. Several California interests have announced their intentions of operating here. Dragline outfits will be active on the Similkameen River near Princeton, on the Cottonwood River near Prince George, and on Spruce Creek.

▶ During 1940, Highland Bell, Ltd., the big Greenwood district silver producer, paid dividends amounting to $105,268, or 8c. per share. In this period one million ounces of silver were recovered from the 7,000 tons of ore, which were shipped to the Trail smelter.

MEXICO

Railroad Extension Will Aid Mining District

Altar producing area in Sonora to have greater transport facilities—Mill for small miners projected in Nacozari

▶Late spring found general conditions in the Mexican mining industry somewhat improved, with a pick-up in lead and zinc exports, but late in April labor trouble suddenly broke out at units of the American Smelting & Refining Co. These events have obscured the outlook for less labor trouble which the industry and many miners had hoped for since the beginning of the year.

▶Mining in a considerable section of northwestern Mexico is to have increased rail transportation facilities as a result of the federal government speeding up the construction of an extension of the railroad it built and is operating between Fuentes Brotantes and Punta Peñasco, Baja California, from the latter place to Santa Ana, Sonora, an important outlet on the Southern Pacific Railway of Mexico. The Altar mining district, Sonora, 150 kilometers from Punta Peñasco, is to be connected with this extension by Dec. 31 and the entire line will be finished late in 1942 or early in 1943. The government is spending 8,000,000 pesos ($1,630,000) on the extension this year.

▶Prospectors and other small-scale miners of Sonora are to be accommodated with the treatment of their ore, particularly low grade, as the national commission for stimulation of the mining industry is arranging to establish a plant especially for this service at Churubibabi, in the Nacozari district. These small-scale operators are having difficulty in getting the large plants to handle their ore because the small content of pay metal makes the treatment too costly.

▶Excepting gold, silver, and a few of the minors, Mexico's mining production in 1940 was considerable below that of 1939, it is shown by the following table for the two years of the ministry of national economy, amounts in kilograms:

Product	1940	1939
Gold	27,468	26,178
Silver	2,570,394	2,359,839
Copper	37,692,455	44,389,580
Lead	196,253,416	219,506,109
Zinc	108,955,122	134,166,278
Antimony	12,267,469	7,873,093
Graphite	12,327,107	9,815,372
Mercury	401,715	254,269
Arsenic	9,267,649	7,062,934
Cadmium	815,734	816,584
Molybdenum	515,837	771,810
Tin	350,729	293,910
Iron	70,159,192	141,334,532
Vanadium	56,962	147,967
Manganese	307,225	26,560
Bismuth	185,433	163,683
Tungsten	102,801	108,861
Cobalt		2
Coal	700,444,411	876,851,154

▶Asarco must pay the Chihuahua government taxes on houses it built for employees of its Parral unit, according to a ruling of the national supreme court in rejecting its injunction suit to restrain Chihuahua from collecting these levies. The company's argument was that as it is operating under a federal concession, and that therefore states'

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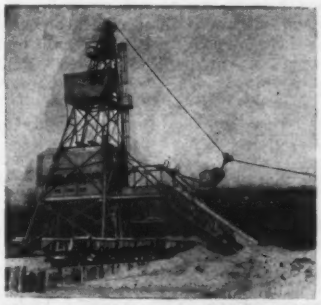

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▶MEXICO

governments have no right to levy taxes against it. The court held that in the case of imposts on houses this and other companies under federal franchise build in accordance with demands of the national labor laws are under states' jurisdictions and therefore the states enjoy the constitutional right to tax such property.

▶ Intervention of the labor ministry settled a dispute between two rival miners' organizations over the distribution of the 650,000 pesos ($115,000) the Cia. Minera Real del Monte y Pachuca, S. A., Pachuca, Hidalgo, recently paid to balance old and new wage scales. This dispute centered about the use of the money for the establishment of a medical clinic and a cooperative consumption society.

▶ Poor business at its units in Torreon, Coahuila, and Monterrey, Nuevo Leon, has obliged Peñoles to ask the labor ministry for authorization to reduce the working personnel of those sections. The company asks permission to dismiss 160 workers at Torreon and 150 at Monterrey. The national miners' union has asked the ministry to investigate the company's contention of depressed business. The union contends that the company can well afford to carry on with full staffs at both units.

▶ Embargoing of La Fluorita and La Azul silver properties, Taxco, Guerrero, as a means of assuring the employees full payment of wages, has been asked of the federal labor authorities by the national miners' union, which asserted that these mines were closed without justification or authorization. Both mines employ 250 men, whom the union declared are in a difficult economic plight as a result of the closure of the properties.

▶ Silver and gold output of the Mexican properties of the United States Smelting, Refining & Mining Co., was substantially the same in 1940 as in recent years, with little change in the tonnage or grade; but with an average silver price of 34.773¢ in 1940, compared with 39.082¢ in 1939, and substantially higher production costs, earnings from this source were materially lower than in 1939. With a continuation of low silver prices, high taxes, and restrictive labor conditions, the outlook at these properties is not considered favorable.

▶ The Federal Board of Conciliation and Arbitration has ordered the American Smelting & Refining Co. to resume operations of its copper smelter at Matehuala, San Luis Patosi, by May 18 and reinstate 800 workers and pay them full wages since July 10, 1940, when the plant was closed. The Board ruled that the suspension of operations was unjustifiable. On the other side, the company asserts it is impossible to continue operations because of insufficient ore of sufficient grade to maintain operations. Appeal to the National Supreme Court against the enforcement of the judgment has been made by the company. The decision of the Federal Board in attempting to force the company to resume operations has dampened the modest optimistic outlook held in the Mexican mining industry since the first of the year.

▶ The lead refinery of the American Smelting & Refining Co. at Monterrey was closed by strike April 27. At this property the union seeks to enforce demands for a work contract providing higher wages and other concessions. These demands the company asserts it cannot meet because of low metal prices. The union declared it has funds to continue the strike for four months, if necessary. The Labor Ministry is seeking to settle this dispute as soon as possible. A strike was also called on April 28 at the A. S. & R. Parral unit, in Chihuahua.

CUBA

Cuban-Amer. Manganese Corp. Increases Output

Annual production recently raised to basis of 100,000 tons of high-grade manganese ore

▶ Net earnings of Cuban-American Manganese Corp. in 1940, a year of record shipments of foreign manganese ore to American ports, totaled $1,062,800, compared with net profit in 1939 of $716,865. Langbourne M. Williams, Jr., president, reported to stockholders on April 17. The 1940 earnings, highest in the company's history, were equivalent to $1.12 a share on the 950,000 shares of common stock outstanding. Net sales of the company, a subsidiary of Freeport Sulphur Co., increased 58 percent from $2,711,060 in 1939, to $4,287,080 last year, the report showed. During 1940 the company paid all accumulated dividends on the preferred stock and an initial dividend of 50c. a share on the common stock. Pointing out that the bulk of the high-grade manganese ore consumed by the United States is supplied from foreign sources, the letter said that in 1940 the Gold Coast supplied 241,000 tons, South Africa 238,400, Brazil 221,850, India 215,700, Russia 179,250, Cuba 130,600, and other sources 67,200 tons, a total of 1,294,000 tons. Domestic shipments totaled 40,000 tons.

▶ "By the latter part of the year, however, shipments from Russia, which for years had been our country's leading manganese source, had been cut off by the complications of the war," the letter continued, "and freight rates from other distant sources had risen, in instances, as much as 500 percent above prewar levels. As a consequence, the delivered price of manganese rose substantially during the year." Wartime requirements of the nation have been estimated by the U. S. Geologic Survey and the U. S. Bureau of Mines at 1,250,000 tons a year. "In support of the government's efforts," Mr. Williams said, "the company early in 1941 expanded plant capacity in Cuba by 30 percent to make possible an annual production of 130,000 tons of high-grade ore. With this increased output it is expected that 1941 sales will approximate those of 1940, which included sales of a substantial inventory carry-over from the previous year."

CENTRAL AMERICA

Modernization Continues At La Luz Mines

Company in Nicaragua is treating around 1,000 tons of gold ore daily and constructing hydroelectric plant and new homes for employees

▶ The first full year of operations of La Luz Mines, Ltd., in Nicaragua, can be considered a most satisfactory one from every point of view, according to the annual report of T. Lindsley, president. 171,551 tons of ore were treated in the mill for a gross bullion production of $1,249,482.31, and with a net operating profit after taxes of $752,885.06 U. S. Cy. The sum of $604,880.67 U. S. Cy. was expended during the year to enlarge the mill, to provide necessary additions to mine plant, to diesel plant, and to camp facilities, and to purchase equipment and carry on work at the Yy River hydroelectric plant. The milling rate was increased from 200 tons per day at the start, to about 800 tons per day early in 1940. It was expected that the milling rate will reach 1,000 tons per day early in January, 1941.

▶ By the use of flotation prior to cyanidation, the present cyanide plant, after adding a few minor items, will be capable of handling the concentrates from 1,500 tons of mill ore per day. Recoveries improved steadily during 1940 and credit is reported due to W. G. Hubler, metallurgist; T. N. Slaughter, mill superintendent; and their staff for the good results. For the next few years, with mining operations largely confined to the open cut, costs will remain low, but when the ore is removed from underground, these costs may rise.

▶ Steady and efficient transportation service by plane has been provided by TACA from Alamicamba, 40 miles east of the mine. When the hydroelectric plant is in operation, the amount of diesel oil transported by air will be materially reduced. Five diesel electric units operated efficiently throughout 1940 and the company is preserving construction work at the Yy River hydroelectric plant, 18 miles distant, and it is expected that when the plant has been completed the entire present load can be carried by this plant. Construction of modern living quarters for the foreign and Nicaraguan employees is being undertaken in 1941. Frank Cameron is general manager; W. G. Hubler, metallurgist; and T. N. Slaughter, mill superintendent.

▶ In 1940 the La India mill, operated by Compania Minera La India, Nicaragua, produced at a daily rate of 275 tons of gold ore and net profits amounted to approximately $610,000, out of which dividends totaling $200,000 were paid during the year. Noranda Mines, Ltd., Canada, owns 63.75 percent of the issued capital stock of this company. Empresa Minera de Nicaragua was incorporated during 1940 to develop another group of claims, and it is expected that a 200-ton mill now being erected at this property will be in operation by May.

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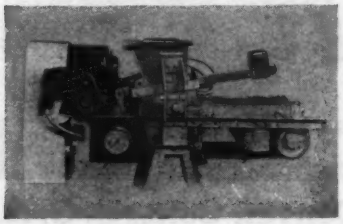

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AUSTRALIA

Gold Mines of Kalgoorlie To Extend Operations

Will explore Oroya North lease—Dredge of Harrietville, Ltd., nears completion

▶ Gold Mines of Kalgoorlie, Ltd., proposes to extend its operations on the Kalgoorlie field. The company's new objective is the exploration of the Oroya North Lease, known originally as the Oroya North Block, which is contiguous on the north and south ends with the leases now being worked. As the old workings do not exceed 1,000 ft. in depth, there is considerable scope, both laterally and vertically, for exploration.

▶ A new gold producer in the State is Burbidge Gold Mines, N.L. During the four-weekly period to Feb. 25, the company treated 4,300 tons of ore for a return of 531 oz. of gold bullion valued at £4,664, or 24s. per ton. The ore is mechanically loaded into motor lorries for transport to the treatment plant. Treatment is simple and comprises fine grinding, cyanidation, and filtration, a high recovery being obtained.

VICTORIA

▶ The superstructure of the Harrietville (Tronoh), Ltd., dredge has been practically completed and several items of machinery have been placed in position. Owing to commitments for defence work, delays have occurred in delivery of machinery from manufacturers, but it is hoped the dredge will be producing before the end of the year. The dredge will be the largest in Australia, with a pontoon 300 ft. long, 72 ft. wide, and 13 ft. deep and will be equipped with buckets of 20-cu.ft. capacity. The property contains 96,000,000 cu.yd. of alluvium having an average value of 1.92 gr. of gold per cubic yard.

▶ New Milano, N. L., has completed and put into operation a five-head mill at its property at Mt. Monger. The battery is running three shifts and treating 15 dwt. development ore from the New Milano mine, No. 3 level.

▶ Due mainly to the treatment of lower-grade ore, and to a lesser extent to increased costs, net profit of Norseman Gold Mines, N. Y., Norseman, for the year ended Oct. 31, 1940, dropped sharply to £55,560 Aust., compared with £112,525 for the preceding year.

▶ Freeburgh Dredging, N. L., which has been operating a small steam-driven bucket dredge at Freeburgh, in the Ovens River district of northeastern Victoria since August last, has declared its first dividend, of 6d. per share. The dredge, which has a nominal capacity of 10,000 cu.yd. weekly, has been treating wash averaging nearly 3 grains per cubic yard (say 12d. in Australian currency). Working costs have been 3.7d per cubic yard.

NEW SOUTH WALES

▶ Wellington Alluvials, Ltd., experienced considerable trouble during the flooding of the Macquarie River early in the year. The dredge, which is the largest at present operating in the Commonwealth, having a pontoon 212 ft. long, 68 ft. wide, and 13 ft. deep, and carrying a ladder 158 ft. long with 115 buckets of 14-cu.ft. capacity, had to be diverted from its course to ensure its safety.

▶ Burma Malay Tin, Ltd., the parent organization of Sesame Gold, N.L., has taken an option, on behalf of the latter company, over a newly discovered gold deposit known as Martin's Reward at Wiseman's Creek, near Bathurst. Operations by the vendors have shown good widths and values. It is expected that at least six months' exploratory work must be done before a reliable indication of the value of the property can be obtained.

SOUTH AUSTRALIA

▶ An important enterprise which will serve the rapidly expanding iron and steel industry at Whyalla and the Broken Hill Associated Smelters lead plant at Port Pirie, as well as the northern part of the State of South Australia generally, has just been commenced with the completion of the first pipe for the Murray River-Whyalla pipeline. Designed to carry 2,100,000,000 gal. of water annually, the line will be 240 miles long, and will vary from 21 in. to 30 in. in diameter. Pipes will be of steel, concrete lined. Construction is estimated to take two years and will employ 300 men.

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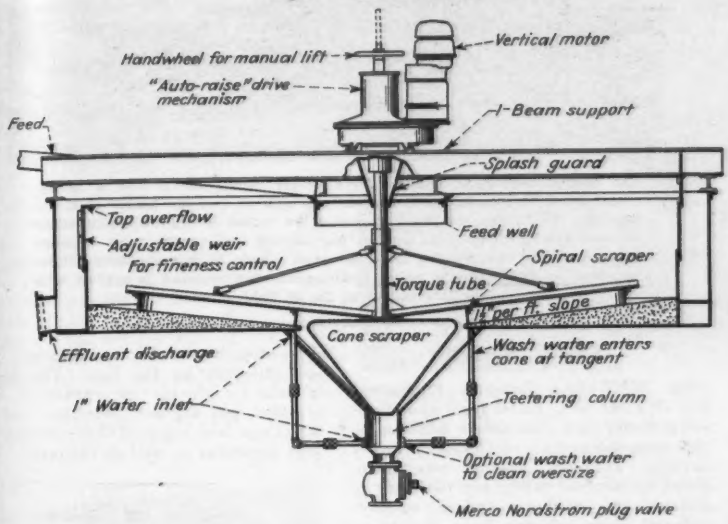
EQUIPMENT NEWS

Improved Classifier



THE HARDINGE CO., York, Pa., announces some improvements in its Hydro classifier. The unit consists of a circular steel tank, shown herewith, divided into two compartments, a main or upper one equipped with an adjustable overflow weir, in which agitating and collecting spiral rakes operate, and a conical-shaped lower one, where a final wash is given the product being made. The simple means now used permits making various sizes of products on one machine by varying the volume available for retention and at the same time the settling out period in it. This is accomplished by using a telescopic type peripheral weir, which is said to permit variation of the classifier depth from a maximum operating depth to one half of its maximum, or at any inbetween point.

A sand product may be made varying anywhere from practically all plus 80 mesh to practically all plus 240 mesh by this arrangement. Extremely fine material is removed as an overflow product.

Another interesting feature of the Hydro classifier is said to be the sand-cleaning chamber below the raking section, where water enters tangentially, gives a swirling action to the sand and removes the last traces of included fines or silt. The machine is operated by a motor through an inclosed oil-lubricated drive gear and includes the Hardinge "Auto-Raise" feature to prevent damage from sudden overloads. Power requirements are small, a 1½-hp. motor being sufficient to operate a 20-ft.-diameter classifier.

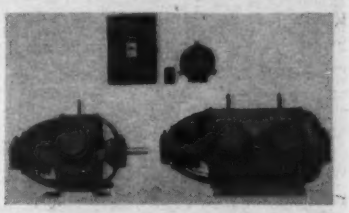
Particle-Size Apparatus

AN APPARATUS to determine particle size below 325 mesh, direct in microns, is announced by Palo-Myers, Inc., 81 Reade St., New York, N. Y. Determinations may be made on almost any substance, provided there is a medium in which the substance is insoluble and a wetting agent that will disperse the particles. The underlying principle of this sedimentation method is based on a modification of the Werner apparatus and makes it possible to determine particle sizes down to 2 microns. The grading below 2 microns is not separated but is recorded as the amount of superfines under 2 microns. When dispersed particles exceed the colloidal dimensions, the particles tend to settle under the force of gravity and the rate of sedimentation offers a means of measuring particle size, applying a logarithmic formula.

This method is said to have a distinct advantage over the microscopic method in that it requires samples of about 2½ grams of materials, whereas in the microscopic method, only a milligram of material is on the slide. Hence an average of 2,500 times the sample is said to be obtained and it is possible to calculate in percentages, which can only be estimated by the usual microscopic method.

New Adjustable Speed A-C Drive

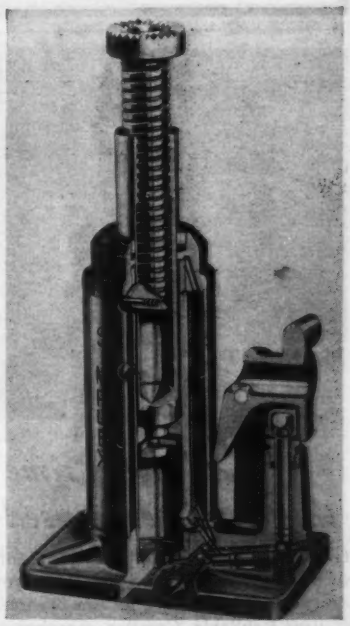
DESIGNED ESPECIALLY for industrial applications requiring smoothly adjustable speeds over wide ranges with constant torque, in locations where only a.c. supply is available, a new 10-to-1 adjustable-speed drive, which uses a series circuit without the usual exciter, is announced by the Westinghouse Electric & Manufacturing Co. It is available in ratings from 1 to 15 hp., with a standard speed range of from 175 to 1,750 r.p.m., for 2- or 3-phase operation on 220-, 440-, 550-volt, 60-cycle systems. The new drive has five parts, as shown in the cut, including control: a single-unit motor-generator set, consisting of a squirrel-cage induction motor driving a series d.c. generator which supplies operating voltage for a d.c. series motor coupled to the driven load. In parallel with the generator series field is a rheostat which controls the driving



motor speed. Control apparatus consists of an across-the-line starter for the squirrel-cage motor, and a pushbutton station. The new drive is said to be more flexible than the wound-rotor motor and is more efficient than the conventional variable-voltage system because it has no exciter rotational losses.

Heavy Duty Hydraulic Jack

ADDING TO ITS LINE of Simplex Lever and Screw Jacks, Templeton, Kenly & Co., Chicago, recently announced a line of heavy-duty hydraulic jacks. Made in 3-, 5-, 8-, 12-, and 20-ton capacity sizes, the manufacturer claims many design and construction advantages including neoprene oil-resistant seals, pressure-tested malleable iron top



nut and base, a machine-ground ram, a fully lapped cylinder, ball-type valves, needle-type load release, center ram for proper balance, and a convenient carrying handle. Operating features common to all models include lower closed height, higher raised height, lighter weight, and leakproof design.

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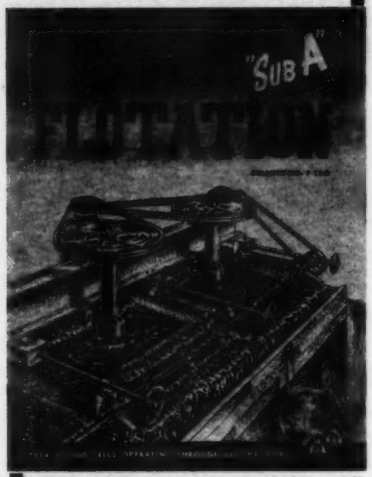

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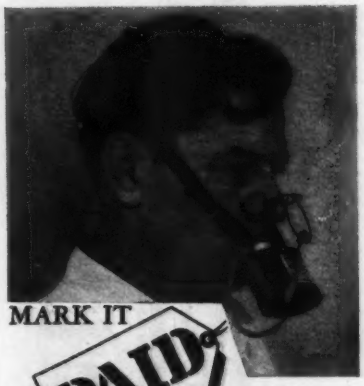

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Ask for Bulletin 4059. E. D. Bullard Co., 275 Eighth Street, San Francisco. B-6

Everything **BULLARD** in Safety

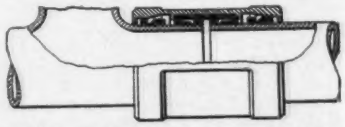
The Walter Four Point Positive Drive tractor, model ADVD with a 200-hp. diesel motor, has been developed for use with an iron-ore trailer of 40 ton capacity. The weight of the tractor and the trailer is approximately 40,000 lb., and the load 80,000 lb., so that this hauling unit carries twice as much payload as its own weight. The total gross weight is approximately 120,000 lb. Three of these tractor trailer combinations are reported in service with the Interstate Iron Co. at Buhl, Minn.

Switch Signal

THE PORTABLE Lamp & Equipment Co., 78 First Ave., Pittsburgh, announces its new switch signal, latest addition to the company's line of haulage safety devices. The new product was introduced to increase safety and efficiency in underground haulage, and it employs red and green reflector disks instead of the usual electric lights. Reflector disks are visible from both sides of the signal. In operation, the device is connected by its paddle arm to the switch bridle bar. When switch is thrown, paddle arm moves automatically, covering either the red or green disks and indicating a closed or an open switch.

Automatic Boltless Ball Grip Couplings

PIPE COUPLINGS consisting of a housing with ball retainers made of flexible sealing gasket or gaskets, offered to assure quicker pipe installation, are announced by The Dillon Company, Tulsa, Okla. The ball retainer or cage carries a number of balls and a frictionally engaging means, so that when the pipe is inserted, the balls are brought into contact with the tapered surface, which is said to cause a positive lock to prevent the pipe from being withdrawn. To withdraw the pipe, the cage is pressed inwardly towards the center of the coupling, which allows the balls to go into larger-diameter space. If the cage is held against the housing it is said to be simple to withdraw the pipe. In the permanent type (see upper cut) the pipe is withdrawn by applying

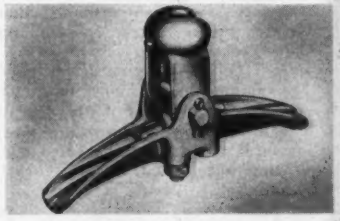


tension and at the same time rotating the coupling.

All couplings can be provided with a pipe stop to prevent unauthorized persons dismantling the line. The design is said to provide for expansion, contraction, and angular deflection, and the couplings are reported fully tested for high pressures as well as vacuum.

Clamps for Hollow Copper Cables

COMPLETING ITS LINE of suspension and strain clamps for hollow copper cables, the Ohio Brass Co., Mansfield, Ohio, announces designs for any type,



size, or make of cable. These clamps meet the recommendations and requirements of the copper cable manufacturers. The two suspension clamps illustrated are typical of the designs developed to meet hollow cable requirements. Strain clamps for hollow copper cable include the principal design features of the company's standard clamps, known as Hi-Lites.

Splashproof Tri-Clad Motors

A LINE OF TRI-CLAD splashproof, ball-bearing, polyphase induction motors in sizes from 1 to 15 hp. has been announced by the General Electric Co., Schenectady, N.Y., to supplement its recently announced Tri-Clad polyphase and single-phase open general-purpose lines. The new line is especially designed to meet the needs of applications where splashing water and other liquids are present.

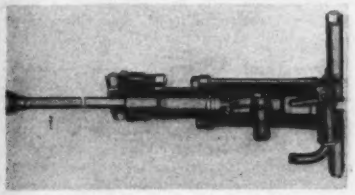
The ventilated openings of this motor's stator frame and end-shields are carefully baffled to block the entrance of splashing liquids. An ingenious arrangement of cast baffles within the side openings of the stator frame effectively blocks splashing from the side. The windings of the new line are of Formex,

G-E's heat- and solvent-resistant magnet wire, carefully wound and impregnated with a special synthetic resin varnish. Cast-iron housings machined to close tolerances inclose the ball bearings for complete protection. The outer portion of each housing is part of the end shield itself, thus eliminating external joints and fits. Ample space for making connections easily and quickly is afforded by the new motor's liquid-tight cast-iron conduit box, which is built into the frame of the motor.

Jackhamer Drill

INGERGOLL-RAND CO., Phillipsburg, N. J., announces its new 55-lb. Jackhamer rock drill which the company designates as the "Easy-Holding" JB-5. It is claimed that because of new features incorporated in this drill it offers easier operation, and permits greater output on the average drilling job.

Features of the new drill listed by the manufacturer are reduced vibration due



to a refined valve action, which conserves use of compressed air, and the easy-opening, long-life steel holder which reduces the time and effort in changing drill steels. This holder is either hand or foot operated. Other features include a drop-forged blower valve handle, large exhaust opening, two piece chuck, thicker cylinder walls, and large bearing surfaces within the drill. The lubrication is exceptionally positive and thorough.

BULLETINS

Fluorescent Lamp Starter. Hygrade Sylvania Corp., Salem, Mass. Form 181 describes the manufacturer's fluorescent lamp starter for 15-, 20-, 30-, 40-, and 100-watt fluorescent lamps. Pp. 4.

Corrosion-Resisting Steel. Bethlehem Steel Co., Bethlehem, Pa. Catalog 156 describes and profusely illustrates industrial uses of the company's corrosion-resistant steel called Mayari-R. Pp. 31.

Ball Bearing Units. Stephens-Adamson Mfg. Co., Aurora, Ill. Catalog 840 describes, illustrates and has many tables of load ratings for various types of ball bearings. Useful engineering information is also included. Pp. 32.

High- and Low-Temperature Insulation Products. Johns-Manville, 22 East 40th St., New York, N. Y. The company offers its new 1941 catalog Form GI-6A containing information and recommendations on high- and low-temperature insulations for every industrial need from 400 deg. F. below zero to 2,500 deg. F. above. The catalog is well illustrated and various types of pressure pipes, stacks, packings, gaskets, roofing, and flooring for domestic and industrial use are described. Pp. 52.

Industrial Friction Materials. Brochure from FM-7A contains comprehensive data on the manufacturer's brake linings and blocks and friction-clutch facings. Technical charts for use of specific types of clutches, brakes, and tolerances for brake linings are also shown. Pp. 11.

Speed Variator. General Electric Co., Schenectady, N. Y. Bulletin GEA 3517 describes the manufacturer's all electric adjustable speed drive operating from alternating current supply. Pp. 4.

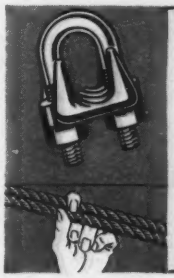
Milling Head for Lathes. Globe Prod-

WHICH MAN WOULD YOU HIRE?

Fauntleroy is on the spot. That U-Bolt Clip of his spoils the rope, breaks it and causes costly delays and accidents. Would you put Fauntleroy to work for you with his U-Bolt Clip?

Spike says, "This Laughlin Safety Clip takes a real fist grip on wire rope! Sure it saves time and money. It's safer, easier to put on, and can't be put on backwards!"

WIRE ROPE USERS! HERE'S THE WAY TO INCREASE YOUR PROFITS!



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can go on backwards
rope breaks
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causes accidents

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easy to tighten
always on right
holds rope
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THIS FREE FOLDER Tells How You Can Get Safety And Savings On Your Present Job — And proves, in dramatic competitive clip tests, that the Laughlin drop-forged Safety Clip is twice as strong — delivering 95% of the strength of the rope.

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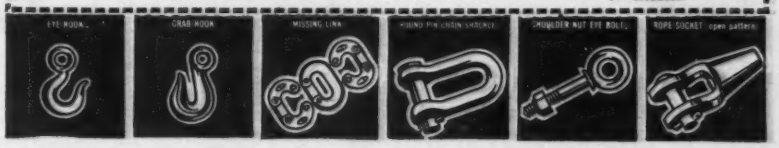

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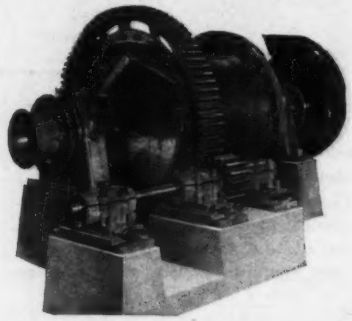
Millions of Tons Ground AT LOWER COST



Williamson Mills are specially designed and built to assure . . . dependable production . . . efficient grinding . . . low cost operation.

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Years of superior performance—millions of tons ground at lower cost—are back of every Williamson Mill.

Let us help you solve your grinding problems.

WILLIAMSON COMPANY

582 Market St. San Francisco, Calif.

ucts Mfg. Co., 3380 Robertson Blvd., Los Angeles, Calif. Form MH 201 describes and illustrates a milling unit that can be attached to standard types of lathes. Pp. 4.

Diesel Engine. Chicago Pneumatic Tool Co., 6 East 44th St., New York. Bulletin 764 describes and illustrates detail features of the manufacturer's new type 16 CP diesel engine. Pp. 8.

Dispersion Dryer. Western Precipitation Corp., 1016 West 9th St., Los Angeles, Calif. Bulletin D-1 features the manufacturer's new Turbulaire dispersion dryer. Pp. 8.

Tractors. Caterpillar Tractor Co., Peoria, Ill. Form 6425 describes and illustrates the company's track-type tractors, road machinery, diesel, and natural-gas engines and natural gas electric sets. Pp. 36.

Hoists. American Hoist & Derrick Co., Saint Paul, Minn. Bulletin 100-H-1A describes and illustrates general-purpose hoists from 1- to 5-ton capacity. Pp. 37. Bulletin 100-H-4A describes steam hoisting engines. Pp. 6. Bulletin 200-D-5 describes a portable material elevator, pp. 4; Bulletin 300-BS-1 describes wire-rope blocks and sheaves. Pp. 16.

Mining Requisites. Hadfields Ltd., Sheffield, England. Bulletin 445 is a new and comprehensive catalog describing and illustrating the company's general mining equipment such as drill steel, castings, crushers, haulage rollers and pulleys, and special steels for mining and other industrial uses. Pp. 23.

Compressed Air Separator. New Jersey Meter Co., Plainfield, N. J. Bulletin DA describes and illustrates the manufacturer's small self-contained unit that is said to automatically eject the condensed water and oil from the air in pipe lines. Pp. 4.

Centrifugal Sand Pump. Denver Equipment Co., Denver, Colo. Bulletin P10-B describes and illustrates features of the manufacturer's vertical centrifugal sand pump. Pp. 4. **Diaphragm Pumps.** Bulletin P8-B illustrates and describes features of its adjustable stroke diaphragm pumps. Pp. 6.

Diesel Engines. Cummins Engine Co., Columbus, Ind. Bulletin 5182 is a handsome brochure illustrating and describing the company's line of diesel engines for various industrial uses. The bulletin has much information on diesels and generating sets. Pp. 35.

Engineering Properties of Inconel. International Nickel Co., Inc. Bulletin T-7 is the latest revised release by the company on this subject. Pp. 14.

INDUSTRIAL NOTES

Profit-sharing checks amounting to $217,818.39 have been distributed to employees of **Fairbanks, Morse & Co.**, 600 S. Michigan Ave., Chicago, Ill., who have been continuously in the company's employ since Jan. 1, 1940.

Dr. Tracy C. Jarrett, formerly assistant metallurgist with the American Optical Co., has been appointed chief metallurgist for Koppers Co., American Hammered Piston Ring Division, Baltimore, Md.

John A. Roebling's Sons Co., Trenton, N. J., announces the appointment of **Horace E. Thorn** as manager of the Philadelphia branch office. Mr. Thorn will have charge of sales and local stock of Roebling's complete line of wire rope, electrical wires and cables, cold-rolled flat wire and specialties, and woven-wire fabrics. **Ernest C. Low** has been appointed general manager of sales of John A. Roebling's Sons Co. Mr. Low has assumed his new duties as of March 1, with headquarters at Trenton, N. J.

Effective April 28th **The Sharples Solvents Corporation,** Philadelphia, Pa., changed its name to **Sharples Chemicals, Inc.** This change in corporate name has proved necessary because of the great change in the nature of the company's business which has occurred over the past few years. Production of many new and organic chemicals and the development of new uses for these materials are said to have made it desirable for the company to be identified as a chemical company rather than as a solvents manufacturer. The company will, however, continue to manufacture those products for which it has long been known.

Wire and cable manufacturers are faced with an acute shortage of shipping reels, spools, and cases primarily through the failure of busy industries to return empty containers. This shortage is threatening deliveries on vital defense orders. Wire and cable manufacturers are buying and making containers as fast as possible, but new containers are not available in adequate volume for the urgent requirements of defense. More containers are needed quickly—all empty reels, spools and cases scattered throughout the nation must be returned to the respective owners and put to work.

Iron and steel and non-ferrous metal interests are rendering fine cooperation in the work of **British War Relief** for the benefit of workers and their families in these trades in the British Isles. More than $157,000 has been raised to date in the non-ferrous metal trade under Chairmanship of **Robert C. Stanley** of International Nickel Co., 67 Wall St., New York, for expenditure by the British War Relief Society, Inc., 730 Fifth Ave., New York. **Harold K. Hochschild,** of American Metal Co.; **Charles Engelhard,** of American Platinum Works; **Baker & Co.,** of New Jersey; and **Irvington Smelters & Refining Company** are cooperating.

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In fine mesh screening, you can speed-up output with the Type C LEAHY No-Blind Vibrating Screen equipped with TRI-VIBE. This increases the effectiveness of vibration and insures greater capacity per screen area. Proved by performance in many fields.

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